JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

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EDITORIAL NOTES—GAS, &c.

The Question of Succession.

IN the gas industry, at the time of his death, Sir George Livesey held but few offices. In addition to his Chairmanship of the South Metropolitan and the South Suburban Gas Companies, he was President of the Society of British Gas Industries, and one of the Trustees of the Benevolent Fund of the Institution of Gas Engineers. There is no pressing need to fill up the two latter offices; but the headship of the directorates of two important gas enterprises is a position that it is wise should not be vacant any longer than necessity and propriety demand. Succession to, and occupancy for the time being of, the Chairmanship of the two Companies was admirably provided for, during the life of Sir George, in the person of Mr. Robert Morton, who was *pro tem.* the Deputy-Chairman of the South Metropolitan Company and the permanent Deputy-Chairman of the South Suburban Company. But Mr. Morton himself will be the first to acknowledge the difficulty of filling a position that has been tenanted by a man concentrating within himself so many remarkable gifts and sterling qualities as those which forced Sir George, without adventitious aids, to such eminence as an administrator of the many-sided and technical gas business. Engineering talent of brilliant grade, master of every detail of process, commercial ability, enterprise with prudence, devotion, frankness, and a clear exponent of affairs before proprietors or parliamentary committees, were among the characteristics that went to make a Chairman of an all too rare order in joint-stock enterprise of specialized kind. The standard of chairmanship that his individuality created indeed ranks very high; and it will be hard for any successor to feel he is worthily wearing, or can worthily wear, the mantle of such a predecessor.

In assisting in the selection of the members of his Boards, Sir George evinced a wise discrimination. He was impressed with the necessity of having upon a gas directorate as wide a range of ability as possible—chosen from men of proved commercial and financial or professional attainments, but always, and foremost in indispensability, two men skilled in the art and practice of gas engineering and manufacture, one of whom should be the Chairman. From this it is clear that his view was that the second gas engineer should, there being nothing to disqualify, in due course take up the reins of the directorate. In the appointment as Chairman of both Companies of Mr. Robert Morton, the policy of Sir George has been confirmed. The dual election is eloquent of respect and confidence. Mr. Morton has, like Sir George, had a long career, as engineer and administrator, in connection with Metropolitan Gas Supply; and in the official period of his life, he assisted in laying the foundations of the professional careers of more than one man holding eminent rank to-day in the gas industry. Through the length of his association, no one has had greater intimacy with Sir George in administration than has Mr. Morton. His credentials are indeed of the highest; and in his hands the policy of the past will, so long as strength permits, be faithfully continued. But the changes made through the death of Sir George, and the accession of Mr. Robert Morton to the double chairmanship, necessitate other changes on the two Boards; and this cannot fail to remind one of the celebrated and deliberate declaration of Sir George on the constitution of gas company Boards that he made at the meeting of the South Suburban Gas Company in February, 1903. That declaration was at the time heartily and unanimously supported by the proprietors; and we feel sure that their endorsement then will not be lightly disregarded by them now. There is the appointment of a new Director of the South Metropolitan Gas Company still in abeyance, and that is a matter for the proprietors. On the Board there is Mr. Frank Bush, whose knowledge of the affairs of the Company, through his long tenure of the office of Secretary and the deep personal confidence that he enjoyed with Sir George, is unrivalled from the administrative side. But, with Mr. Morton in the chair, there is not at the moment a second gas expert on the Board; so that, if Sir George's views on this matter are now respected, the vacancy in the directorate will be filled by a gas engineer. There are stepping-stones across most streams; and there are not a few who would be sooner or later (and the sooner the better) delighted to see in this case the final stone passed. The Deputy-Chairmanship of the Board of the South Metropolitan Company is not a fixed appointment; it is merely a nominal distinction conferred upon one of the members annually by his colleagues.

Sir George laid it down as a rule of prudence, and plainly indicated his desire, that, after he relinquished the positions through age or death, the chairs of the two Companies should be occupied by men technically trained in the gas industry, and that the remuneration should be such that more time than is ordinarily devoted to the work by the elected head of a joint-stock business could be bestowed by the Chairman or Chairmen upon the affairs of the undertakings. While the most natural proceeding, it does not, of course, follow that the deputy-chair need be occupied by a gas engineer for strict observance to be made of the wise desire of the late Chairman, although it is usually found that the occupier of that office, unless there be some disability in the way of infirmity, looks upon accession to the higher office as a prescriptive right. In the case of the South Suburban Gas Company, Mr. Jabez Light has been elected Deputy-Chairman. Mr. Light is an able, amiable gentleman who enjoys the full confidence of his colleagues and the proprietors. He is not, however, a technically trained gas man; and therefore his appointment—we are not in any man's secrets over this matter—may only be a temporary one. If it is not, and is intended to serve as an open door to the higher position, then—and we say it with all respect to Mr. Light—it will hardly be fulfilling the ratified line of best policy in reference to the directorate as traced by Sir George at that memorable meeting in February, 1903. Experience, based upon technical training, in gas engineering and management, and not seniority as a member of the Board, was the chief qualification then laid down for a gas company's chairman. There is, however, yet a new Director to be elected; and when that election is made, it may—no one outside the confidence of the Board can yet tell—afford fresh information for those who like to weigh the possibilities of the future.

A Memorial.

IN the present generation of gas engineers and administrators, the living contact there has been with the leader who, in the midst of intense sorrow, has just been laid to his final rest, will cause memories of both his exemplary life and incomparable work to be ineffaceable, and to future generations the superstructure that has been erected on foundations he himself laid will be of him the grandest of memorials. In last week's issue, Mr. Sydney Y. Shoubridge appealed to the gas industry to show its appreciation of Sir George Livesey's work in a way which, he knows, would have pleased him best, and that is by carrying on the great purpose of his life, the spreading of co-partnership. That appeal is cordially endorsed in these pages; and there will be no laxity on our part in taking advantage of opportunity to press both the righteousness and—may we not insist more than ever to-day?—the necessity for the acceptance of the principles for which he laboured so earnestly and pertinaciously. There must be no slackening of fervour in the cause now that Sir George has passed from our midst. If he could but speak to-day, he would—consonant with his life among us—deprecate any talk of a memorial simply because he did unostentatiously what he considered to be his duty, and because what he did was rewarded by such an abundant success.

But to serve the greatest ambition of his life, he would eagerly second Mr. Shoubridge's proposition, although he would rather that higher reasons than his own life's work were advanced for the adoption of co-partnership. However, Sir George is not with us; and his work to those who have had contemporary part and lot in the gas industry will be his monument to their dying days. But the gas industry is not measured by the span of man's life; and there will be others who will come after who have not known Sir George in life. We have put on record in these pages an outline of the work of his pregnant career, and have also told of the remarkable demonstration of sorrow, love, and esteem that there has been on the "crossing of the bar." That record will continue; but we should like to see some memorial, in imperishable material, set up in some prominent place by the professional and administrative workers in the gas industry of to-day that would in the ages to come bear, to succeeding generations of gas engineers and administrators, enduring witness to the deep personal regard and affection felt for him whose life in the industry was unique, whose work for it did so much to mould its good fortune. We will not at present make further suggestion in the matter, but will leave this opening for the next move to be made by others, promising all the assistance possible in the way of publicity and support that can be given through our columns. There will, we are confident, be a spontaneous reply to any proposal put forward under proper auspices.

The Utilization of Coke-Oven Gas.

It was a coincidence that on the very day Mr. J. Mogford, of Briton Ferry, was reading his paper before the Welsh Gas Association (*ante*, p. 46) on the gas supply of Glamorgan, and was advocating the utilization by gas suppliers of coke-oven gas through the aid of high-pressure distribution, Mr. C. H. Merz was pleading before the Iron and Steel Institute for co-operation between producers of coke-oven and blast-furnace gas (or as he described them producers of waste heat) and electricity power companies, whereby the waste energy of the former might be, to mutual advantage, turned by the latter into useful marketable energy. It is curious that at most points the gas and the electricity industries come into commercial conflict; and it would be somewhat extraordinary if, in relation to this question, there should eventually be competition between them for the purchase of the gas produced by coke-ovens. Whether there will ever be competition in this respect, depends altogether on the answer that can be given to the question, Will it pay? On the first blush, excepting in districts contiguous to the coke-ovens, it certainly appears that there is a greater measure of practicability on the side of the electricity power companies than on that of the gas suppliers. We say on "first blush," and also taking into consideration the gas suppliers' statutory obligations. In the immediate vicinity of bye-product coke-ovens, where a gas is obtained with an illuminating power equal to (say) 8 or 9 candles, enrichment by benzol can be resorted to, and a profitable distribution of the gas can be effected. An interesting experience was related by Mr. A. W. Branson, at the Welsh meeting, in respect of the supply of coke-oven gas, by the Rhymney and Aber Valleys Company, to 500 or so slot-meter consumers, using incandescent burners. It has been successful; and, moreover, in the area concerned, the coke-oven gas, including enrichment, has enabled the price of supply to be reduced by 9d. per 1000 cubic feet. The experience is useful knowledge, but nothing more.

In utilizing such gas, the gas supplier whose situation is near enough to enable him to do so with profit, has, to ensure compliance with his statutory obligations, to do two things: He must keep by him sufficient spare gas-producing plant to fill any shortage in the supply of the coke-oven gas from whatever cause, and he must bring the gas up to the illuminating level satisfying absolute parliamentary requirements. The suggestion has been made that, for gas suppliers at a distance, the coke-oven gas might be transmitted to them by high-pressure mains. But this is precisely where, with an erratic supply of coke-oven gas dependent for its volume entirely upon the degree of employment and shutting down of the coke-ovens and upon labour troubles and so forth, the financial picture painted by the visionary or the enthusiast fails in stirring up conviction as to practicability. A stand-by retort plant at the gas-works equivalent to the maximum delivery from the coke-ovens has to be provided for; and this means idle capital, upon which interest has to be provided. Enrichment by benzol cannot be effected without entailing some labour and capital expenditure, and the handling of an additional liquid material, which material is subject to variations in market price. This, again, all means money. There is further the capital required for the high-pressure mains for the conveyance of the gas; and the pressure plant for driving the gas through. This represents still further capital, interest, and working expenses. Then there would also be the uncomfortable feeling that the supply would fall short just at the most inopportune moment. Taking these various matters into account, the utilization of coke-oven gas, except by gas undertakings in the immediate vicinity of such plants, does not appear to offer sufficient financial inducement and certainty; but the matter is worth entering into with greater minuteness before being finally dismissed as altogether impracticable.

Electricity power companies are therefore, there seems little reason to doubt, in a better position than gas undertakings to take advantage of this coke-oven gas, providing there is the custom for the electricity. In the first place, the gas is usable by them direct in the cylinders of gas-engines without enrichment; and its energy can be converted directly into electricity, and be transmitted with greater freedom. The electricity power companies only require the energy for power purposes; and not for the variety of objects that the gas supplier requires his commodity to be capable of serving. This being so, the illuminating quality of the gas is not a matter that the electricity company need consider; and the variation in the output of the gas from whatever cause will not occasion him so much trouble, nor require so much stand-by plant as would be the case with the gas supplier. If the coke-ovens began to close down, it is pretty certain that in the area around their location, the industries that would require electrical power for driving would simultaneously be suffering under the same cloud of depression, and would not be demanding energy on the prosperity scale. On the other hand, the electricity power companies would never depend entirely on waste-gas driven plant, but a very large part of their supply would still be from steam-driven sets. Under present conditions, they have to provide stand-by plant; and that plant could readily pick up the variations in the downward direction in the supply of gaseous energy from the coke-ovens. If the gas supplier was in a position to distribute coke-oven gas for power only, there might be something of a level established between him and the electric power company. The former would not require to convert the gas into a new form of energy. His pressure plant and high-pressure distributing-mains with the gas-engine at the far end would suffice. The electricity supplier would have his gas-engine and dynamo at the seat of gas production, the product would be sent through the distributing cable, and the electric motor would be at the other end. The difference between the two for the single purpose is not therefore great, though Mr. Merz does not appear to have been able to establish a case favourable to the transmission of the gas as compared with the alternative of the conversion of the gas into electricity and then transmitting it. Mr. Merz does not publish his calculations, and his *ipse dixit* seems to have been accepted as the word of incontestable authority at the meeting of the Iron and Steel Institute. We do not even know whether in his calculations he made any allowance for the loss produced by conversion of the energy of the gas into electrical energy, and the consequent loss of efficiency as represented by indicated work at the point of use, nor that he reckoned the loss of the converted energy during transmission. A bare statement such as Mr. Merz advanced on this head does not disclose much foundation for examination by critics.

Anyway it is the gas-engine—much maligned by electricians—that comes to the rescue of the wasted energy from coke-ovens and blast-furnaces; and the gas-engine therefore bids fair to prove a potent agent in the economy of fuel for power purposes. What is being done on Tyneside is too striking to be passed with a cursory glance. The paper by Mr. Merz was really a plea for greater co-operation between the producers of waste gas and power companies, and an argument why the owners of plant producing such waste gaseous fuel in which there is profit would do better by working hand in hand with the power companies than proceeding independently with isolated electricity generating plants. What Mr. Merz suggests is that the producers of such waste combustible gases should (as it were) "pool" their surplus production in the Power Companies working on Tyneside; and that the Companies should, at what are called

their waste-heat stations, convert all this gaseous secondary product into electrical energy. A substantial start has already been made in this direction up North; for out of generating stations representing 101,950-horse power, there is 13,650-horse power of plant installed for operation by waste gas, and out of 34,600-horse power in three stations under construction 4600-horse power are also to be provided by waste gas. Mr. Merz, with his intimate knowledge of the district, avers that it is probable that next year half of the energy used for power on Tyneside will be produced by waste heat. This is a condition of things that is almost startling as a piece of rapid development. The Power Companies concerned in this do not seem to be very particular whether they purchase surplus electricity from the coke-oven and blast-furnace owners, or whether they buy the gas direct, convert it into electrical energy, and supply the sellers of the gas with the electricity they require in the ordinary way of business. The argument in favour of this is that the magnitude of the business the Power Companies do brings about compensation and economy, and irons-out the fluctuations the maker of the gaseous secondary product would himself feel through the variations of output and of demand for energy. The electricity suppliers are in a position to buy as much gas as is produced, and to sell to the coke-oven or blast-furnace owner just as little or as much electricity as he requires. There does not seem to be any idle boast about this, if the figures presented by Mr. Merz are authoritative—that on the north bank of the Tyne, there is not a single firm of shipowners or engineers who do not take 95 per cent. of their power from the Company, the remaining 5 per cent. being produced from small gas-engines or from scrapwood used under boilers.

On the point of relative advantage, there are several other matters the producers of this waste gaseous energy have to consider; but we need not name them all. The chief are the financial question, and that of the relative reliability of taking electrical energy from the Power Company, or the private retention of full control of generation. There are arguments *pro* and *con*. If there is not financial advantage on the balance in following Mr. Merz, then there is no use falling into his scheme. But this must be remembered, that there is only one Tyneside in the country; and local circumstances would alter the argument of even such an effective and eloquent advocate as Mr. Merz. We are, however, reminded by the paper indirectly of the Coalite Company, and the rich gas they are expecting to produce from their works when constructed at Barking; and that rich gas it is believed is now intended to drive gas-engines for the production of electricity if the scheme of the London and District Electric Power Company goes through Parliament this session. Of course, that rich gas as produced will not be the best possible for gas-engine work.

The Proneness to Failure.

The Borough Councils of London and the various Metropolitan Liberal Associations are greatly troubled, viewing the matter from different aspects, over the London and District Electricity Supply Bill, which will be coming before the House of Commons in this the concluding part of a much divided session. In effect, the Borough Councils and the Liberal Associations hold views that are somewhat antagonistic. The Liberal Associations are alarmed by the knowledge that the Government are disposed to grant a private Company such large powers over London, and are of opinion that the supply of electricity in bulk should be centralized in a municipal authority. We know quite well that, at the back of this outbreak on the part of these political bodies, are those comrades in action, the Progressives and Socialists. One of the arguments that carried a resolution protesting against the measure at a meeting of the delegates of the Liberal Associations the other day was the recent breakdown at the Lot's Road generating-station, whereby there was chaos and darkness in subterranean London. But such a happening is just as likely under municipal centralization; electricity in its want of constancy being no respecter of human authority. The Lot's Road generating-station represents the latest word in equipment; and the London County Council Greenwich station claims to be modern in its every part. Yet it is not long since that the Greenwich station suffered a breakdown which put into a helpless condition some 600 to 800 tramcars. This is all against concentration; and the Associated Municipal Electrical Engineers have called attention to it.

These municipal electricity engineers quite naturally—they have a personal interest in the matter—desire to maintain the existing condition of affairs electrical in London, and cry death to the interloper. We are quite at one with anybody who says the existing condition of electricity supply in London is bad enough; it is difficult to find any occasion for statutory sanction to make it worse. But the discerning public, after reading the letter that the Associated Municipal Electrical Engineers have sent to the Press, will argue, and quite logically, that if disturbances in supply can happen with such modern equipment as the Lot's Road and Greenwich generating stations can boast of, then what protection have electricity consumers against collapses in the case of the ordinary—say, municipal—central stations. These breakdowns are proof of the susceptibility of even the most modern plant to easy derangement, with a heap of evil result altogether out of proportion to the cause. But that is one of the drawbacks of electricity supply. Hearken to what these Associated Municipal Electrical Engineers say: "If "this scheme is carried out and a serious breakdown should "occur, the disastrous effect of the failure of such a large "source of supply, even for half-an-hour, would be impos-"sible to estimate, for not only would it result in stoppage "of all trains, trams, and factories, but all streets, theatres, "hospitals, shops, &c., would be placed in darkness—in fact, "London would be in a state of chaos, as was Paris only a "short time ago, when, owing to a strike, the electricity "supply to Paris was cut off." That is a terrible picture, and should set Londoners thinking.

In their argument against concentration, the Associated Municipal Engineers, who have been truthful up to this point, run a little off the path of rectitude. But this may be a slip through limited knowledge. They say that the concentration of other public supplies to London has proved that such proposals do not, in practice, work out to the benefit of the ratepayers in general, but rather the contrary. They refer "to the concentration of the London gas supply "in the hands of the Gaslight and Coke Company, and to "the water supply in the hands of the Metropolitan Water "Board." Now, what is there wrong in these days with the Gaslight and Coke Company? The undertaking is working out its destiny to the satisfaction of all those responsible and of those competent to judge. But, as a matter of fact, the London gas supply is not concentrated in the hands of the Gaslight and Coke Company. The South Metropolitan and the Commercial Companies are not insignificant concerns; and they are also engaged in the supply of gas to London, and, like the Gaslight and Coke Company, from several stations. But when the Associated Municipal Electrical Engineers talk about the gas supply of London not being worked for the benefit of the ratepayers in general, we are reminded that many a municipal undertaking has been propped up by the rates, and by extortionate charges for the public lighting service. Taking it all in all, municipal trading in electricity has not worked out "to the benefit of "the ratepayers in general, but rather the contrary."

High-Pressure Inverteds for Fleet Street.

There is an innocent looking report in our "Miscellaneous News" columns with reference to high-pressure inverted lighting in the City. It tells us that the Court of Common Council of the City of London have agreed to a recommendation of the Streets Committee that an experiment be made in Fleet Street of high-pressure inverted gas lighting, by sixteen lamps on brackets at a cost not exceeding the present charge for lighting the thoroughfare—viz., £264 per annum. No one can accuse the Court of Common Council with unfairness in this matter of competition for the main street lighting of the City. In the important avenues of the hub of the Empire, the at-one-time drowsy controllers of the City electricity supply had for years been pretending to illuminate them at a cost of something like £26 per point. Then the City Authorities created an awful storm in the electrical camp by adopting high-pressure gas-lamps in Queen Victoria Street and low-pressure ones in Fleet Street; and this gave the electricians such a shock that they could not rest again until they had shown what they could do with a few flame arc lamps at £17 10s. each, meantime sticking tenaciously to the 400 or so others that are still costing the ratepayers £26 each per annum. Not long since the two Electricity Companies were invited to make further trial; and it will now interest them to see

that the Gaslight and Coke Company are not going to take this additional demonstration by electricity lying down. That is the secret of this Fleet Street demonstration; and it is to be by the Keith 1500-candle power single inverted high-pressure gas-lamps, each consuming only 25 cubic feet of gas an hour. It will be remarked that sixteen of these lamps are to be used; and that there is a guarantee that the cost shall not exceed the present charges for lighting the street. If £264 be divided by sixteen, it will be seen that the yearly cost per 1500-candle power lamp will be £16 10s., which, reckoning 4000 lighting hours per annum, is under 1d. per hour per 1500-candle power light. The lamps will be carried on brackets, and not on columns on the pavement, so that there will be no high columns such as are used for arc lamps causing obstruction, nor will there be any addition to the network of overhead wires in the City.

A Lecture from the "Electrician."

Our contemporary the "Electrician" has been reading the gas papers a lecture on criticism, or rather it calls its admonition "A Word on Criticism," but as two columns are occupied by words, and there is a hint at the end that there is more to follow, the designation being in the singular is hardly appropriate. We are not at all averse to reproof if deserved when it comes from a quarter that is above reproach; but our contemporary who speaks now with oleaginous tongue of "a friendly spirit of criticism" was only the other day talking in its pages of the "demoralizing influence of the deadly agent"—the agent being gas—"either as an illuminant or as a domestic heater," and of the "influence of the fumes of gas." The friendly spirit of criticism shown in these blood-curdling descriptions of gas was the result of mental intoxication over the fact that the municipal electrical engineers of London in their associated capacity were publishing some scandalous and slanderous posters pictorially decrying gas, which posters our now remonstrating contemporary thought would "influence the sales of electricity," and would "create something of a sensation in 'gaseous' circles." Well the principal part of the lecture that affects the "JOURNAL" is concerned with the public lighting of the City of London, and particularly with an article contributed to our columns by Mr. Norton H. Humphrys. We acknowledge the friendly admission that what has been written on the City of London lighting in these pages is "legitimate criticism;" but there is nothing in what our contemporary now says on the subject in question that calls for comment on our part, excepting that it may be pointed out that large units of illumination are produced by the gas industry because there is a demand for them, and not because the gas industry generally regards them as supplying the best means for uniformly lighting the streets. As will be seen in another paragraph, the latest form of 1500-candle power high-pressure inverted gas-lamp will, as soon as a high-pressure pipe is run down the wood paving of Fleet Street, be on view in the City. Other topics reserved for comment by our contemporary are the mural posters upon which such great store is set for cultivating custom for electricity, and the question of electric cooking. The posters have been alluded to above. As to electric cooking, we should like to know whether or not it is true that the catering at the Manchester Electrical Exhibition owes much to the gas-stove and little, if anything, to the electric cooking-stove. It would be a cruel thing if a rumour of this kind received wide circulation, and there was no foundation for it in fact.

Smoke and Gas.

In dealing with the nuisance caused by the existence of smoke in large residential and industrial centres, Mr. James Swinburne had a subject with regard to which there can be no two opinions to bring before the Association of Engineers-in-Charge last Wednesday. That the trouble does exist, and that it is a very serious one, is admitted on all hands; the possibility of materially mitigating, if not actually curing, it is the point upon which attention is centred. Referring to factories, Mr. Swinburne suggested that boiler furnaces should be constructed of fire-brick in such a way that plenty of room was allowed for the hydrocarbons and the air to mix thoroughly, as well as ample time for the combustion to be complete. But great as is the nuisance in this respect that arises from the burning of coal in factories, Mr. Swinburne is of opinion that house-fires are a still more important source of smoke, and at the same time far more difficult to legislate against, because of the smallness of the nuisance caused by each individual fire. The solution of the domestic smoke trouble, he says, seems to lie only in the direction of the use of smokeless fuel and gas heating; for "at present, from the purely smoke point of view, electrical heating is outside practical politics, as it is not yet likely to become universal in small houses." While, however, thus admitting the important part that gas-stoves are called upon to play in the purifying of the air of our towns, Mr. Swinburne has some criticism to offer on them which would hardly seem to be justified by a close study of all that has of recent years been accomplished in the way of improvement. The objection to allowing a gas-flame to play upon surfaces which interfere with the combustion is much more generally realized than Mr. Swinburne gave credit for in his address; and so far from it being the case, as he asserts, that there are now very few good gas-stoves to be had, there are many patterns on the market which are capable of giving the highest possible satisfaction to the most fastidious of users. It may well be that there is still plenty of room for improvement in the ordinary gas-stove; but then that is a remark which can pretty safely be made with regard to most mundane things. Perhaps Mr. Swinburne, when penning his criticism of the gas-stove, had not before him specimens of the latest types of these appliances. Certainly he had not in mind the most recent achievements in gas legislation when he said "probably the gas companies will soon give up supplying gas which has a high illuminating power in the ordinary sense, as that is rapidly becoming useless." He might fairly have said "are giving up," instead of "will soon give up."

Awards at the Franco-British Exhibition.

The awards have been made for the exhibits at the Franco-British Exhibition. The shower has been a copious one in every department; and nearly every exhibitor appears to have got something. Therefore everyone should be happy. But the way in which diplomas for grand prizes, diplomas of honour, and diplomas for gold, silver, and bronze medals, have been scattered, rather detracts from their value; but there are other exhibitions promised at Shepherd's Bush, so that perhaps it is diploma-cy to treat first patron with generosity. We do not say that those who have got diplomas, whether for grand prizes or gold, silver, or bronze medals, or diplomas of honour, or merely honourable mention, are not deserving of all they have got; perhaps had the adjudication been in our hands we should have placed the awards, or some of them, differently. But whether the awards be of high grade or low grade, not much harm has been done by their bestowal, or will be done by their acceptance. Regarding acceptance, the authorities, bearing in mind the scrupulous attention they paid to the question of payments by the exhibitors, can well afford the diplomas and the medals, the honour, and the honourable mention.

Municipal Finance at Bradford.

In accordance with a resolution passed last August, authorizing the Loans Sub-Committee to appoint an independent qualified accountant and auditor, or firm, to examine and report upon the financial method of working of each Committee of the Corporation, with a view to ascertaining whether the existing system is the best obtainable, the Committee have selected Mr. W. B. Peat, F.C.A., to carry out the work. When the matter came before the Council, some discussion took place with reference to the period to be covered by the inquiry; and ultimately it was agreed that Mr. Peat should be instructed to go as far back as he might consider necessary in his investigations to discover defalcations. The consideration of specific cases of defalcation, of course, is a matter that affects Bradford alone; but the terms of reference themselves seem to foreshadow an inquiry of wide scope, the results of which may be of interest to other places besides Bradford. It has, as already remarked, been arranged that Mr. Peat is to examine and report generally on the financial method of working of each Committee of the Council; and this will involve consideration, among other matters, of the present system of book-keeping and audit, the desirability of an audit of income and expenditure in place of the existing audit of receipts and payments, the necessity of having an audit department to carry on a continuous audit, and the efficiency of the present system for affording the various committees—and more especially the trading departments—the information from time to time

needed to enable them to properly control their business. When it is mentioned that the total capital cost of the trading concerns in Bradford has been close upon seven million pounds, of which five-and-a-quarter millions still remain as debt, the necessity for the Council assuring themselves that their financial arrangements are of the most complete kind will be at once admitted.

SIR GEORGE LIVESEY'S PUBLIC BEQUESTS.

We are enabled to announce that the employees of the two Gas Companies with whom Sir George Livesey was so closely identified will eventually be largely benefited under the terms of his will. We understand that Sir George has provided that, on the death of Lady Livesey, the sum of £15,000 of the ordinary stock of the South Metropolitan Gas Company shall be set aside for investment by Trustees—the Chairman and three or four other officials of the Company for the time being. The interest accruing (after payment of certain annuities) will provide a fund to meet exceptional cases of hardship and distress among the Company's employees of all ranks and their widows—such benefaction to be so dealt with as not to pauperize the recipients or interfere with their independence. A very wide trust is, it is said, created in regard to this matter. Similarly, £2000 of stock in the South Suburban Gas Company is set aside for the employees of that Company. At the present prices of the stocks named, the two amounts for investment would be over £20,000. What is likely to be a further large sum (the amount cannot at present be even hinted at) will —also at the death of Lady Livesey—be added to the funds of twelve or more public Institutions, some of them closely identified with the temperance movement, concerning which, as is well known, Sir George held very strong views. They will benefit in certain defined proportions in the residue of the estate after the specific legacies named in the will have been provided for.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 223.)

The course of things on the Stock Exchange last week was naturally dominated by the ominous events in Eastern Europe, though our own domestic questions at home could not be wholly excluded. The general feeling was sensitive and cautious; but at times it was momentarily relieved by optimistic views and suggestions of possibilities. These, however, were not in the ascendant at the close. It was account week, and the absence of any difficulties over it was a favouring factor. The opening was fairly good on Monday, and things were inclined to look up. Bear accounts were closed, and prices recovered. Consols rose $\frac{5}{16}$; and Home Rails and foreign stocks were much better. On Tuesday, it appeared that the upward move had been rather overdone, and most markets recoiled; but a good point was the firmness of East European stocks. On Wednesday, the pendulum was back again, and everything was on the rise as if all difficulties had been smoothed out. The same tendency in a lesser measure was the characteristic of Thursday. But Friday administered a check as the political horizon became overcast, and the bright view began to fade. Prices shrank, though there was no heavy fall, and dulness prevailed generally. This was intensified on Saturday, when sundry lions in the path that should lead to a pacific Conference gave rise to apprehension. The labour problem, too, of how to deal with the two totally distinct classes—the "Want-work" and the "Wont-work"—was there. So markets receded, and the close was dull. The Money Market disclosed an abundant supply at easy rates, but discount was rather firmer. Business in the Gas Market was quiet and not remarkable for aught but continued firmness with a rising tendency. In Gaslight and Coke issues, the ordinary was unchanged, and transactions were marked at from 97¾ to 98½. In the secured issues, the maximum realized 87½ and 88, the preference from 105⅝ to 106¾, and the debenture 86. South Metropolitan was also quiet and unchanged, marking from 120⅝ to 121¼. The debenture was done at 85 and 85¾. Commercials were neglected; the 4 per cent. only being done at 107¼ and 107¾. In the Suburban and Provincial group, Alliance and Dublin changed hands at 19¼ *ex div.*, British at 42⅝ *cum div.*, Brighton original at 209, Brentford old at 246½ and 247½, Tottenham "A" at 136, ditto "B" at 106¾, and West Ham at from 102 free to 104½. There was little business done in the Continental companies. Imperial marked 182½ and 184, and Union 108. Among the undertakings of the remoter world, Buenos Ayres changed hands at 11$\frac{17}{32}$, ditto debenture at 94½, Primitiva at 5¾ and 6, ditto preference at 5 and 5⅛, ditto debenture at 98¼, River Plate at 13⅛ *ex div.*, and San Paulo at 14⅜.

Census of Production Act.—In the "Journal" a fortnight ago p. 17), it was mentioned that forms had been prepared by the Board of Trade with the view of obtaining the information required under the above-named Act. Two of them, relating to gas and water undertakings, drafted by the Director of the Census of Production, have been issued; and we have now received from him a copy of the schedule for the manufacture of compressed gases which has been prepared by the Department.

AWARDS AT THE FRANCO-BRITISH EXHIBITION.

The list of awards in connection with the Franco-British Exhibition was published last Thursday morning. The following are those in which our readers are chiefly interested.

Diplomas for Grand Prizes.

Applebys, Limited.
British Mannesmann Tube Company, Limited. (2)
British Westinghouse Manufacturing Company.
Cambridge Scientific Instrument Company.
Carron Company.
Chance and Hunt, Limited.
Crossley Bros, Limited.
Cutler, S., and Sons.
Eagle Range and Stove Company, Limited.
Gaslight and Coke Company.
Gas Undertakings of the United Kingdom. (2)
Lambton Collieries, Limited.
Mather and Platt, Limited. (3)
Power Gas Corporation.
Stewarts and Lloyds, Limited. (2)
Thames Iron-Works, Shipbuilding, and Engineering Company.
Wigan Coal and Iron Company (Mr. A. C. Scriveler).

Diplomas of Honour.

Applebys, Limited.
British Mannesmann Tube Company, Limited.
Clapham Bros.
Clayton, Son, and Co., Limited.
Glenboig Union Fire-Clay Company, Limited. (2)
Harrison, G. King, Limited.
Kitson Empire Lighting Company.
National Gas-Engine Company.

Diplomas for Gold Medals.

Bailey, W. N., and Co., Limited.
"Bat" Meter Company, Limited.
Best and Lloyd, Limited.
Bland Light Syndicate, Limited.
Edgar, William.
Gibbons, B., jun., Limited.
Gibbons Bros., Limited. (2)
Ingram and Kemp, Limited.
Jenkins, W. J., and Co., Limited.
Keith and Blackman Company.
Körting Bros.
Laddite Incandescent Mantle Company.
Lambton Collieries, Limited.
Messenger and Sons.
Mobberley and Perry, Limited.
Newton, Chambers, and Co., Limited.
Pneumatic Gas Lighting Company.
Pulsometer Engineering Company, Limited.
Richmond Gas Stove and Meter Company, Limited.
Taylor, J., and Co.
Wilsons and Mathiesons, Limited.

Diplomas for Silver Medals.

Anti-Vibration Incandescent Lighting Company, Limited.
Applebys, Limited.
Cannon Iron Foundries, Limited.
Evered and Co., Limited.
Ewart and Sons, Limited.
Gaslight and Coke Company.
Gibbons, B., jun.
Hands, G., and Co.
Harrison, G. King, Limited.
Jenkins, W. J., and Co., Limited.

Diploma for Bronze Medal.

Richmond Gas Stove and Meter Company, Limited.

Diplomas for Honourable Mention.

Davis Gas-Stove Company, Limited.
Main, R. & A., Limited.
Scott-Snell Self-Intensifying Gas-Lamp Company.
Tilley, Bros.

Scottish Junior Gas Association (Western District).—The Hon. Secretary and Treasurer (Mr. G. Braidwood, of Dawsholm) has issued the syllabus for the winter session of the Western District Section of the Association, from which it appears that the opening meeting is to be held in the Glasgow and West of Scotland Technical College, Montrose Street, Glasgow, next Saturday evening. The President (Mr. A. H. Whitelaw, B.Sc., of Glasgow) will deliver his Presidential Address, which will be open for discussion. The subsequent arrangements are: Nov. 7, paper by Mr. J. F. Harrison, of Glasgow, on "Steel Work, Illustrated by the Erection of the Forth Bridge;" Nov. 21, visit to the Coatbridge Gas-Works; Dec. 5, paper by Mr. J. M'Ghee, of Glasgow, on "Heating and Lighting;" Dec. 19, annual social; Jan. 9, 1909, paper by Mr. S. B. Langlands, of Glasgow, on "Labour Questions;" Jan. 23, visit to the Dawsholm and Temple Gas-Works; Feb. 13, paper by Mr. G. H. M'Cowat, Assoc.M.Inst.C.E., of Glasgow, on "Distribution of Gas—Main Laying;" Feb. 27, visit to the Paisley Gas-Works; March 13, papers by Mr. J. Goldie, of Airdrie, on "A Modern System of Gas Lighting," and by Mr. F. Cuthbert, of Perth, on "Producers and Secondary Air Supply;" March 27, joint visit to the Carron Iron-Works; April 10, general business meeting and lecture by Mr. H. O'Connor, F.R.S.E., of Edinburgh, on "Suction Gas."

THE LATE SIR GEORGE LIVESEY—THE FUNERAL PROCESSION.

THE LATE SIR GEORGE LIVESEY.

On the opposite page we give five photographic reproductions of scenes at the funeral of the late Sir George Livesey. The centre picture (taken by Mr. Edwin W. Taylor, of Peckham) shows the hearse entering the cemetery gates, followed by the carriages loaded with the floral offerings. The smaller pictures at top show the hearse leaving the Old Kent Road Gas-Works, and the officers of the Companies following the carriages; those at the bottom of the page show the district men heading the procession of the workers of the two Companies; and the Ambulance Corps bringing up the rear. The clock in the first and fourth of the small photographs shows that the procession took 23 minutes to pass through the works gate.

Society of British Gas Industries.

At a special meeting of the Council of the above Society held last Tuesday, the following resolution was unanimously passed: "That the Society of British Gas Industries have learned with very great regret of the death of their highly esteemed President, Sir George Livesey, and desire to put on record their appreciation of his unfailing ability and courtesy in all matters connected with the Society during his presidency, and to convey to Lady Livesey their sincere sympathy." A copy of this resolution has been sent, with a letter of sympathy, to Lady Livesey. In this connection, it should be stated that in the list published last week of floral tributes, the name of the Society was inadvertently omitted.

As a mark of respect to the late President (who had promised to take the chair on the occasion), it has been decided not to hold an autumn meeting this year, and to postpone the annual dinner to the February meeting.

Sir George took an intense interest in the Society, of which he was the second President, having succeeded Mr. Dugald Clerk; and he thoroughly believed in its objects, and its power for doing excellent work in the industry. Had he not thought this, he would never have consented to become its President; and that his prior judgment was ratified by experience is shown by a letter received by the Secretary (Mr. Arthur L. Griffith) after the last meeting, at which the President delivered his address. In this letter, he remarked that it was from first to last an extremely pleasant meeting, and strongly confirmed his opinion that the Society was thoroughly good in its methods, objects, and results; and, at the end of August, in another letter, he gave corroboration by remarking: "I may say that the position of President has been very gratifying."

Suggestions for Memorials.

Mr. A. Canning Williams, the Secretary of the Reading Gas Company, forwards the following copy of a letter he has sent, on the instructions of the Directors of his Company, to the Secretary of the Institution of Gas Engineers.

The Secretary, Institution of Gas Engineers,
39, Victoria Street, London, S.W.

Dear Sir,—At a meeting of the Directors of this Company held on the 13th inst., references were made to the death of Sir George Livesey; and there was a unanimous feeling that a worthy memorial of one who rendered such magnificent and enduring service to the gas industry, and whose life as a citizen was so honourable and beneficent, should be undertaken. The suggestion was made that a biography of Sir George would form a fitting part of such a memorial, as it would be a record of noble work and an incentive to emulate his example.

The Company's Engineer informed the Board that your Institution were moving in regard to a "Livesey Memorial;" and I am instructed to say that my Directors would willingly give their support to any Memorial Fund that may be opened by the Institution.—Yours faithfully,

(Signed) A. Canning Williams, Secretary,
Oct. 16, 1908. Reading Gas Company.

In a letter to the "Kentish Mercury," Mr. A. Meynell Sly, of Lewisham High Road, referring to the death of Sir George Livesey, mentions the very prominent part he took in securing Telegraph Hill Park as an open space for the use of the public, and his gift of about £2000 and a drinking fountain in connection with it. Mr. Sly says: "I am surprised to find that there appears to be no notification of his generosity recorded anywhere in the park. There is plenty of room for an inscription on the fountain; and therefore I hope the London County Council will take steps to see that the memory of Sir George Livesey is perpetuated by fixing a tablet thereto, or in some other convenient place."

High-Pressure Lighting in Front of the Bristol Gas Offices.—On Monday night last week, the front of the new offices of the Bristol Gas Company was lighted for the first time by eight large Keith high-pressure lamps of the style of those in use at the Franco-British Exhibition. The effect was admirable, and produced what was practically daylight over a great part of the street and the façade of the building. The Chairman (Alderman J. W. S. Dix) and other Directors of the Company were present, to judge the effect, and were greatly pleased with it. The lamps are each of 1500-candle power, making in all 12-000-candle power; and they consume together 200 cubic feet of gas per hour; so that at the price of gas in Bristol the cost is not quite 5d. per hour. The lamps are worked by a compressor and gas-engine or by a water compressor at will; the engine and compressor occupying a space 3 feet by 2 feet.

ELECTRICITY SUPPLY MEMORANDA.

West Ham Deficiency—The Power Business Swamping the Lighting—Capital Obligations—Decreasing Average Income per Unit—Stagnant Business for Other than Power—An Advertisement and Its Statements.

There has in the past been in these columns some criticism of the West Ham Electricity Department; and it is therefore only fair, when officials of the undertaking court further comment upon their affairs generally, that it should be generously accorded. We have to thank Mr. A. Hugh Seabrook, the Engineer and Manager of the Department, for his urbanity in sending us a copy of his report and accounts for the last financial year—the salient feature of which is that there was a deficiency at the end of the year of £4669, including the £1829 loss of the previous year. The revenue increased by £9745, but the expenditure went bounding up to £12,586, of which £7372 is entered against working expenses, and £4470 is for increased capital charges. This latter item should cause serious meditation when the flights of capital outlay and the nature of the new business for which it is being largely incurred, are considered. There are certain special items that go to make the working expenditure larger than it otherwise would be; but every year, as a rule, will bring its own special charges. Among the charges is £500 for "breakdown of machinery at a large consumer's premises." It is also observed that coal cost £2145 more than the previous year; but this is partly due to increased output from the station, and not all to higher price. There has no doubt since been a reduction of price to the West Ham undertaking as elsewhere, though not perhaps to the former level; but the increase in the consumption of fuel with advancing output will continue, and this must all be put to the account of the service for power.

It is on this question of power supply, in its relation to the deficiency and to the private lighting, that there is most interest. In his report, Mr. Seabrook refers to the assertions that have been made to the effect that the financial losses are due to supplying power below cost price, but still maintains that the charges are correctly calculated and applied. Mr. Arthur Wright has been engaged to inquire into this question; and Mr. Seabrook is evidently cognizant of what Mr. Wright will report, as he says "the Committee will feel more confident on this point after they have received the report now being prepared by Mr. Arthur Wright on the operations of the department." In considering this price question, it is important to bear in mind that the consumption for power last year exceeded by about a million units that for private lighting, so that the latter, from the quantitative point of view, has become (although producing the greater revenue) the secondary branch of the business, and must be so regarded in connection with future capital expenditure. Now if, between the hours of 5 p.m. and midnight 1,959,482 units produced £23,641, and in major part during hours of daylight 2,835,178 units produce only £12,426, there is not much difficulty in seeing which branch of the business is most lucrative; and certainly it cannot be charged against the lighting department that it is not paying its way. Then to which of the other departments of business must the loss be attributed? It is also evident, as will be seen by the slow progress that is now being made by the lighting business in West Ham, that the present plant is fully adequate for dealing with the profitable branch of the business, and that all future capital expenditure that is made on plant will be exclusively for the power branch, which should therefore bear the full weight of the additional capital obligations. Nor should it be overlooked that this power business will be subject to the vacillations of trade depression and prosperity. Prosperity means greater capital expenditure for the undertaking; depression, smaller business with continuing full standing charges.

This is a matter into which we may look a little more closely, and from another aspect. There were in all (including traction) some 9,015,097 units of electricity sold last financial year, against 7,092,610 units the previous year. *Primâ facie*, this is an increase upon which the department might be congratulated, were it not that it is not altogether clear where such increases of business are going to land the undertaking. Let us take only the total figures given under private lighting and power supply. We know that the figures include a small amount for lighting supplies charged on a time basis; but as this only amounts to £120, it will not vitiate the argument. Now in the year ending March 31, 1907, the electricity sold for private lighting was 1,925,410 units, in the past year 1,959,482 units—an increase of only 34,072 units. Private lighting revenue in the respective periods was £23,337 9s. 5d. and £23,640 18s. 11d.—an increase of only £303 9s. 6d. This does not look as though electric lighting, despite the fact that it is advertised in West Ham as the cheapest of all means of illumination, is making much headway. In the year ending March, 1907, the amount of electricity sold for power purposes was 1,357,456 units, as compared with 2,835,178 units last year. The revenue for power for the respective years was £5766 8s. 6d. and £12,426 3s. 8d. (which last figure is, singularly, about the amount of the increased expenditure for the past year). It will be seen from this that the business for private lighting has made slow progress; that for power has more than doubled. The private lighting business in point of fact between April and August this year has receded—the revenue having in that period decreased by £600. Now adding together the units sold for private lighting and for power in 1906-7, and the receipts from these two sources, we see

that the average revenue per unit amounted to 2·12d. Dealing the same with the figures for 1907-8, we find that the average receipts per unit were only 1·8d.—that is to say, a drop of 0·32d. in the average revenue per unit. Mr. Seabrook's estimates of some time since, as to the expansion of business in the lighting department, have not been fulfilled. It is freely admitted that this is not due to any want of perseverance in trying to secure an extension. On the other hand, the power business at low rates has increased luxuriantly; and, unfortunately for West Ham, the revenue per unit has fallen, amalgamating the two sources of income, by 0·32d.

Where is this drop in revenue per unit going to stop? West Ham is essentially a place where there is bound to be greater difficulty henceforth in obtaining good electric lighting business; while the prospect is that the power business will accumulate even more. Unless, therefore, there is a proportional *pari passu* drop in the average expenditure with that in the average receipts per unit, it is inevitable that the financial position of the undertaking of West Ham will go from bad to worse. It is pointed out that the generating costs have fractionally decreased per unit; but it is not only in generating costs where there must be reduction to compensate for the average drop in the receipts per unit. A part of the existing capital expenditure is, and the greater part of the future capital expenditure will be, entirely on account of power supply; and the capital charges properly attributable to power supply must necessarily go up. And meantime this power business is fast reducing the average receipts per unit of electricity sold. We shall see before very long where this financial policy is leading. It is not overlooked that Mr. Seabrook is trying to inspire hope, on the presentation of these (from the financial standpoint) miserable accounts, by stating that, for the first five months of the present year, there has been obtained an increased revenue over the whole undertaking, including the sales department, of £6052, at an increased cost, including capital charges, of £1731. We should really have thought that Mr. Seabrook had had sufficient experience in "counting his chickens before they were hatched." He has before endeavoured, and has succeeded, in inspiring hope; but hope in West Ham has had an unhappy knack of not materializing.

The braying of the West Ham trumpets over the cheapness of electric lighting for small property does not appear to have drawn so much custom as a travelling cheap-jack would expect to net from the same amount of noise. There is an item in the accounts, "special lighting, artizans' dwellings;" and against it stands an income of £362 15s. 8d., which is £20 less than in 1906-7! In Mr. Seabrook's report, it is mentioned that a number of these installations required "considerable overhauling," which means expense. In the heating business, an additional £79 was taken for the twelve months; so that there was an increase in private lighting of £303, and in heating of £79, and a decrease from artizans' installations of £20. Thus, in these three items, there is an advance of £362 in business, which sum looks strangely out of countenance when contrasted with these items of expenditure: "Publicity expenses, £502 18s. 10d.," and "'Bulletin' (*less* advertising, &c.), £48 13s. 2d." As these figures are contemplated, we remember the advocacy of Mr. Seabrook, in respect of systematic and persistent advertising. The harvest is not altogether encouraging; and there is cruel mockery in the legend, or rather fabrication, painted in bold letters on coal bunkers in West Ham, that "electricity is cheaper than gas." While on expenditure, it is interesting to notice that under repairs and maintenance in the distribution department, there is an item "motors (including cost of fixing), £1990;" and under income "hire of motors, £1391 13s. 2d." The relation of these figures does not strike one as particularly good business; it seems to suggest another loss attributable to the power business. It is also observed that rates and taxes are charged at only £176 18s. 5d.; and this is an undertaking on which £419,277 (not including works paid for out of the general district fund amounting to £11,357) has been spent! Ratepayers who are not electricity consumers should note this, and particularly watch the proposed revision of the rating. The fact should also be marked that the ratepayers have provided out of their own pockets £11,357 for capital expenditure. Another interesting point is that, for street lighting, 361 arc lamps and 143 incandescent electric lamps (using 790,180 units of electricity) cost the ratepayers £6634 16s. 3d., included in which sum is an expenditure on these lamps of no less than £1856 17s. 11d. for wages, carbons, and general upkeep. Unless some miracle happens, even with the easier coal market, the financial position of the West Ham Electricity Department is not going to be transformed yet awhile into one that will be the envy of other electrical engineers.

People have been asking why Messrs. Siemens Bros. find it necessary to go outside the papers devoted to the electrical industry into those associated with the gas industry to advertise their tantalum electric lamps. We do not know, and do not care, as we suppose that Messrs. Siemens Bros. are the best judges of where to place their advertisements. Indeed, it is not any particular business of ours that the advertisement pages of the "JOURNAL" have in the months preceding the opening of the lighting season been selected by the firm for certain of their announcements. We accept the honour they have done us with the greatest modesty, and may point out to those who question the wisdom of the firm in scattering their announcements in the enemy's camp that Messrs. Siemens Bros. are perhaps more 'cute in this matter than they are given credit for. They may know, we cannot tell, that there are now numerous electricians who week by week read these pages in order to keep closely in touch with the position of the (to them) somewhat engrossing question of competition. The firm certainly know that the business in private electric lighting plants driven by gas-engines is an expanding one, especially in country districts; they are also aware that many gas engineers are now using electric lamps in those portions of their works (such as purifier-houses) where there are chances of accumulations of gas; they are likewise cognizant of the fact that there are gas engineers who also hold the office of electrical engineer; they also know that there are many Corporations who own both gas and electricity undertakings; and they are not wrong in thinking that many town councillors, for their own information and guidance, weekly peruse the "JOURNAL." It is not very peculiar therefore that Messrs. Siemens Bros. should desire that their announcements should meet the eyes of all such readers. Being prepared to pay the price of such advertisement, it is not for us to insult such a reputable firm by declining their announcements, nor to dictate to them the statements that shall be made in them. To decline or attempt to dictate would but indicate weakness or fright on our part. We can only object to advertisements if there is in them anything personally offensive or indecorous, or if the form of the advertisement is in any other way objectionably foolish for a technical publication. But, nevertheless, we do not deny ourselves the privilege of asserting that—if the firm are making comparison with modern incandescent gas lighting, and taking for their basis a comparative light—there is no truth in the statement contained in their advertisement of last week that "electric lighting with tantalum lamps is cheaper than gas lighting." Our correspondence columns are open to Messrs. Siemens Bros.; and we are fully prepared to discuss the point with them.

THE MANCHESTER ELECTRICAL EXHIBITION.

[SECOND ARTICLE.]

IN making a survey of the exhibition, we have only the interest of the man in the street, *plus* that of competitors for business. For their engineering beauties or usefulness, there is interest in much of the plant and accessories shown—in the gas-engines, the steam-engines, steam-turbines, boilers, mechanical stokers, steam economizers, superheaters, packings, dynamos, machine tools, &c. The machine tools are attractive to the gas engineer in these days when mechanical operation takes so large a part in the processes of gas manufacture and the transport of material, and when, therefore, there is a large amount of repair work to be done on gas-works. At the exhibition, naturally, these machine tools are shown driven by electric motors. But, in our days of cheaper gas supply for power purposes, there is no doubt that, where machine tools are assembled so that they can be driven from common shafting, the gas-engine will and does show superior economy in working. Where the machine tools are isolated, the gas-engine can also be used as the prime mover in the generation of electric energy for distribution about a works at a saving upon the cost of a supply from the town mains.

Boilers and accessories are mentioned above. This reminds us that these are days when fuel economy must be studied, and all waste eschewed. Fuel economy is best accomplished by watchfulness, and watchfulness finds valuable ancillaries in such instruments as CO_2 recorders and calorimeters. The CO_2 recorder shown on the stand of Messrs. Alex. Wright and Co., Limited, courts notice. Since first acquaintance was made with this instrument, the joint workers—Messrs. Simmance and Abady—have introduced further improvement; and the smooth motions of the mechanism are pretty to look upon. But it is precision of record that is required; and, by this instrument as now made, there is no question in our minds that the makers can substantiate their assertion that it is second to none. Their patent combustion recorder and calorimeters have also had a large amount of consideration turned upon them, to bring them up to a perfect state. In the same class, there is the firm of Messrs. Sanders, Rehders and Co., Limited. Their trade name "Sarco" is placed before a big range of useful instruments. There are CO_2 recorders for boilers and gas plants, draught and pressure gauge recorders, fuel calorimeters, pyrometers, and so forth. They are showing, too, a new gas volume recorder, attached to a Daniels gas plant, which indicates the actual volume of gas used by the engine. The instrument is specially designed to measure large volumes of hot or dusty gas, which cannot be metered in the ordinary way. The Bristol Company (Messrs. J. W. & C. J. Phillips) are well-known to gas men; and they, too, are exhibiting their various specialities in the way of recording gauges for steam, gas, and water, as well as thermometers for feed water, superheated steam and flue gases. Their pyrometers are worth examination.

But we will now turn to the side of the exhibition which is intended to appeal to the public, and among other evil results to wrest business from the gas supplier. While it is the magnanimous intention of electricians to swallow up the gas industry, and leave its vast capital unproductive and on the waste heap, we find that it is also a well-established law among the makers of electrical appliances to do their utmost to kill one another by decrying each other's goods—pointing out their defects and the incomparable advantages of their own. No doubt this is business; but it must lead to a lot of confusion in the public mind. Illumination from

flame arc lamps predominates in the show; and the competitors appear to think and speak all manner of evil against their neighbours. A representative of the public starts to seek for information about these lamps; and the loquacious attendants tell him all sorts of things he cannot understand about their own and other people's goods, until the visitor is induced to think that a few volts across the attendants' own terminals would not be at all amiss. One goes up to the stand of the Oliver Arc Lamp, Limited, to hear that the "Oriflamme" lamp is "the only one on the market suitable for street lighting and able to compete with high-pressure gas lighting." Now that is a remarkably interesting statement, as it limits considerably the task of the gas competitor in meeting the claims of electricians putting forward flame arcs in competition with high-pressure gas. The Oliver Lamp Company have not heard of the 1500-candle power high-pressure gas-lamp, using only 25 cubic feet of gas per hour. But what is it that makes the "Oriflamme" lamp the "only one" now on the market able to compete with high-pressure gas lighting? We learn that it is the low consumption of 280 watts by the 7-ampere lamp, 360 watts by the 9-ampere lamp, and 440 watts by the 11-ampere lamp, and also to the fact that the cost of the carbons is exceedingly low—being only 0·1d. per lamp-hour. But now mark the further declaration: "This figure is about one-third to one-sixth the cost of carbons in other flame lamps." This point will be worth bearing in mind whenever electricians propose to lighting authorities that flame arcs other than the "Oriflamme" shall be adopted in the streets. The "Oriflamme," if reliance is to be placed on the statements of the Oliver Company, may therefore be taken as the standard of efficiency for electricity against which calculations have to be made by the gas manager.

When the Gilbert Arc Lamp Company's stand is reached, the representative of the public is invited to be the judge of the relative degree of truthfulness of the Gilbert and Oliver antagonists. Pointing to one lamp, the Gilbert attendant will tell his visitor that "where the best burning is required, this is the best lamp on the market." Then another lamp is shown which has the virtue ascribed to it that "the carbon consumption is lower than that obtained with any flame lamp;" and that "the lamp is adapted for any lighting where very long hours and low maintenance costs are required." Now, if the carbon consumption is really lower with this lamp than that obtained with any flame lamp, how can the Oliver statement be true that their cost for carbons is only one-third to one-sixth that of any other flame arc lamp? What is more, the Gilbert people impress the fact that the Stepney Borough Council have recently placed an order with them for 73 of their multiple carbon lamps for street lighting "after exhaustive comparative tests." The Gilbert and Oliver people have some differences to settle. Meantime, the public get a bit confused over such contradictory statement. A couple of columns in one of our electrical contemporaries under the heading of "The Virtue of Truth in Business Enterprise" might not at this juncture be amiss—using as illustration of present-day degeneracy pictorial posters, certain praise thereof, and the assertions of electric lamp makers and "Bulletin" editors. There is also a divergence of statement on the part of the attendants at the Exhibition respecting the protection, in case of competing flame arc lamps, of the metal parts from the deteriorating action of fumes, the ventilation of the lamps, and the maintenance of the globes free from deposit. In the catalogue advertisement of the Westinghouse Company, there is an indirect slap at certain types of flame arc lamps, in the declaration that the Westinghouse form has no clockwork or other delicate mechanism to get out of order. Coming down to smaller lamps, the much tormented representative of the public finds that the Gilbert Company have further "broadened their phylacteries, and enlarged the borders of their garments," and are crying out in the market places that their small enclosed lamps "are not weakly made toys, as are most of the other small lamps on the market, but are well and strongly made."

We have lingered long enough on flame and other arc lamps; and there are the incandescent electric lamps still to be noticed. The various new forms of metallic filament lamps have not got it all their own way in the Manchester show. Messrs. Siemens Bros. are forward with tantalum lamps; and the carbon filament lamp makers indicate no intention of throwing up the sponge. Of course, of the efficiency of the metallic filament lamp over the carbon filament lamp, much is made to the inquirer; but the attendants are not over-favourable to the person who commences to talk about the cost of adapting a present installation for metallic filaments, about the use of transformers for the small candle power low-voltage lamps, the additional installation expenditure occasioned by applying transformers, the electrical losses of transformers, and the initial and renewal costs of the metallic filament lamps. Messrs. Body and Co., the makers of the "Metalik" filament lamp, have no great objection to the public knowing what are the prices of their productions, which are made for low voltages from 16 to 100 candle power and for high voltages from 50 to 100 candle power. The lamps have an efficiency of 1½ watts per hour, will burn in the sloping position, and have a reputed life of over 1000 hours. In other words, to get a light from a single point of 100 candles, a unit of electricity would be consumed in eight hours; and given a life for the lamp (if good fortune attends the user) of 1000 hours, two new lamps would be required by the use of the light for about 1800 hours per annum. For high voltages the 100-candle power lamps cost 8s. 6d. each. Therefore, one 100-candle power lamp suitable for a voltage of 200-250 would, in 1800 hours, use 225 units of electricity, which, at 4d. per unit, would represent £3 15s. per annum. Two lamps at 8s. 6d. each would add another 17s.; making in all £4 12s. for a 100-power light per annum, running for 1800 hours! The prices for these lamps are worth quoting, as they are advertised as "the best and the cheapest:" 50-70 volts, 16-candle power, 3s. each subject; 50-65 volts, 25-candle power, 3s. each; 66-125 volts, 25, 32, 50 candle power, 4s. each; 70-130 volts, 100-candle power, 7s. 6d. each; 200-250 volts, 50-candle power, 6s. each; and 200 250 volts, 100-candle power, 8s. 6d. each. But the carbon filament lamp people are not in this exhibition confessing that they are going to be snuffed out. The Robertson Electric Lamp Company, for instance, come up as bold as ever, and demonstrate some of the operations—not all, owing to the very stringent regulations governing public exhibitions—of their lamp manufacture; the heat required in the operations being obtained by the aid of gas blow-pipes supplied with air under pressure and coal gas from the town mains. Much obliged for the patronage. While still on lamps, it is noticed that the Robertson Company point out that their lamps are British-made throughout—this being a slap at the metallic filament importations. It is noticed that many of the fittings on view at the exhibition bear a striking resemblance to the designs—some old—more especially brought out for inverted gas-lamps.

The exhibition, we understand, has been designed principally for boosting business in town electricity supply; but various exhibits—such as gas-engine and oil-engine sets—have been admitted which challenge town supply in point of cheapness. The "Rational" electric lighting system is one of these plants for private use; and the makers put forward their cost figures as comparable for the same amount of light for 1000 hours' lighting: Carbon filament lamp, town supply, at 5d. per unit, 43s.; at 4d. per unit, 35s. Flat-flame oil-lamp, 21s. "Incandescent gas" at 3s. per 1000 cubic feet, 13s. "Rational" system: Small sets, 8s. 0¼d.; large sets, 6s. 6¾d. In an exhibition that is supposed to be devoted to the interests of electricity, the expensiveness of electric lighting by distributed electricity is being shown up in this vivid manner! It is alleged that town electricity is much dearer than privately produced electricity; and that incandescent gas lighting puts electric lighting by town electricity completely out of the running. But we would point this out to the makers of the "Rational" plant that, if our calculations are correct, they are only basing their computations on an illuminating power of about 32 candles; and as a light of 32 candles can be obtained by incandescent gas-burners with a consumption of 1⅝ to 1¾ cubic feet per hour, in 1000 hours at the most only 1750 cubic feet would be consumed, which at 3s. per 1000 would amount to 5s. 3d.—not 13s. This is not the only set of plant in the exhibition that claims to give the user a good return for his money; there are other sets, with oil or suction-gas engines as the motive power, which claim to give the user electricity cheaper than any town distributed supply. The promoters and supporters of the exhibition who are engaged in central station electricity supply can hardly afford to welcome these independent plants and their saucy pretensions to superiority in the matter of cost. But it is publicly known that great as is the Manchester Corporation electricity station, Messrs. Crossley Brothers, with a gas-engine and suction-gas plant, are the guardian angels of the exhibition—standing ready day-by-day to take on the electricity supply to the exhibition in the event of the public supply collapsing. A failure at an exhibition advertising electricity supply would be a disaster that could not be lightly explained away.

It was expected that we should have concluded the notice of the exhibition in this second article, but there are still other matters on which comment has to be made.

In a short article on the fire risks at the Manchester Exhibition, the "Electrical Review" praises the electric light for its safety, and describes as a "fortunate thing" for the profession that fire insurance offices appreciated the necessity of fire protection in the early days of electric lighting. The insurance people are deserving of all blessing for this; "for in this way have we learned what precautions are necessary to safeguard our private and public buildings." There is a veritable multitude of these precautions outlined in the rules and regulations of the fire insurance offices. Following on its laudatory remarks on the point of safety, our contemporary observes: "To-day, the fire office expert is expected to know something of everything. He must be well acquainted with building construction, with fire producers and fire protection, and the hazards of all the various manufacturing and commercial occupancies of different buildings or factories. The Manchester Electrical Exhibition is a case in point. A wooden structure of a somewhat flimsy nature, with drapery extending from the roof along each side, no fireproof material in any part of the main building, or in its exhibitors' stalls, no supply of hydrants along the avenues, so far as we could see; and we have an ideal structure, to be reduced in an hour or two to a heap of ashes by the 'outbreak' of an 'incipient' fire." It will be remembered that in our first article last week, it was noticed that among the exhibits at Manchester are fire extinguishers and fire alarms. Why?

The autumn meeting of the Southern District Association of Gas Engineers and Managers has been fixed for Thursday, the 5th prox., at 2.30 o'clock, at the Hotel Cecil, when the usual routine and other business will be transacted—including papers by Mr. Riley, of Swindon, and Mr. Pye, of Chichester.

REGULATIONS FOR AUTHORIZED GAS FITTERS.

We recently published a set of rules and regulations dealing with the practice of gas-fitting as followed by some of the chief gas undertakings of America. By the courtesy of the Committee of the Lancashire Commercial Section of the Manchester District Institution of Gas Engineers, we are now able to give a summary of a similar list of regulations covering the same work. These regulations as issued in pamphlet form by the Section may to an extent be taken to represent English practice. The preface states that the rules and regulations thus formulated for "authorized gasfitters and consumers" were drafted as the result of a suggestion that a standard list would be of great service to the members of the Section. The conditions of each district obviously vary considerably; and a number of alternative regulations have therefore been inserted to suit different circumstances.

The regulations cover the ground fairly well, as may be indicated by the following headings taken from the pamphlet. They are: "Gas-Mains and Service-Pipes," "Meters," "Internal Pipes and Fittings," "Gas-Engines," "Escapes," "General," and "Conditions of Supply." It may be perhaps a matter of opinion; but we think the pamphlet would have read better if its contents had been somewhat differently arranged. The sequence would have been improved if the paragraphs under "General" and "Conditions of Supply," for instance, had been placed at the beginning instead of the end, and the several instructions as to meters (at present under two headings) kept together in the section entitled "Meters. Some repetition might thus have been avoided. In a pamphlet of this sort, too, intended more particularly for the use of gas-fitters other than those engaged by the gas undertaking, some of the clauses of the General Gas Acts which deal with supply might usefully have been included. There are at the present day many fitters ignorant of the legal enactments governing gas supplies and of the rights of gas undertakings. The above is not said by way of adverse criticism but of suggestion in case of a reprint of this useful pamphlet.

We may briefly summarize the matter dealt with in the "Regulations" under each successive heading.

Gas-Mains and Service-Pipes.—Instructions and information are given as to the laying of service-pipes from the main to the consumers' premises; and the following table is included showing the size of meter inlets and outlets, and the number of lights allowable.

Size of Service-Pipe, Etc.

The size of the connections to the inlet and outlet of each meter must correspond with that of the main cock or valve, specified in the following scale:—

Size of Meter for Lighting only.	Size and Material of Service Pipe.	Size and Material of Main Tap.	Size of Inlet and Outlet.	Union Couplings or Flanges.	Maximum No. of Lights allowed to be fixed.		Fittings allowed with "Authority's" Meters.	Hire of Meter — Charge per Quarter.
					Public Institutions and Business Premises	Private Houses.		
Light		Brass.					Main Tap and Key.	
3	¾" W.I.	¾ × ⅝ in.	⅝ in.	Union	5	6		
5	¾" ,,	¾ ,,	¾ ,,	,,	8	10	,,	
10	1" ,,	1 ,,	1 ,,	,,	15	20	,,	
20	1¼" ,,	1¼ ,,	1¼ ,,	,,	30	40	,,	
30	1½" ,,	1½ ,,	1½ ,,	,,	45	60	,,	
50	1¾" ,,	1¾ ,,	1¾ ,,	,,	75	100	,,	
60	1¾" ,,	1¾ ,,	1½ ,,	,,	90	120	,,	
		Iron or Brass.						
80	2" ,,	2 in.	2 ,,	,,	120	160	,,	
100	2" ,,	2 ,,	2 ,,	Union or Flanges	150		,,	
150	3" C.I.	3 ,,	3 ,,	Flanges	225		Valve	
200	3" ,,	3 ,,	3 ,,	,,	300		,,	
250	4" ,,	4 ,,	4 ,,	,,	375		,,	
300	4" ,,	4 ,,	4 ,,	,,	450		,,	

Meters.—Particulars are here furnished as to position, the space required, and the general fixing of meters.

Internal Pipes and Fittings.—The paragraphs in this section deal with the notices to be given by authorized gas-fitters on the completion of any work, sizes of piping to be used, weights of lead and iron tubing, piping for gas cookers and fires, precautions to be observed in preventing water accumulation, and also to ensure the proper fixing of pipes and fittings. We may perhaps abstract the clauses dealing with the size of internal piping. It may be remarked, in passing, that fitters may experience some difficulty in reconciling the number of lights allowable by this table with those permitted by that of meter connections,

(*a*) The outlet must not be diminished in size on the meter side of the first branch pipe leading to the lights. No piping of less diameter than ½ inch will be allowed as a main; ¼ inch piping is only allowed to be used for vertical pipes supplying one jet. It is advisable to carry forward into all sculleries a pipe of not less than ½ inch diameter, in order to provide a sufficient supply for grillers or boiling rings.

(*b*) Greatest length and maximum number of lights allowed for various sizes of pipes, at ordinary pressures,

Internal Diameter of Pipe.	Greatest Length Allowed.	Maximum Number of Lights Allowed.
Inches.	Feet.	
¾	6	1
⅝	20	3
½	30	6
⅜	40	11
¾	60	18
1	80	35
1¼	100	60
1½	150	100
2	200	200
3	400	450
4	600	800

The minimum weights of lead and iron piping are given as under.

Internal Pipes and Fittings.

The lead and iron piping used for gas fittings must be to the satisfaction of the gas engineer or his representative, and of not less than the following weights:—

Lead and Compo Pipes.			Iron Pipes.		
Internal Diameter of Pipes.	Weight per Lineal Foot.		Internal Diameter of Pipe.	Weight per Lineal Foot.	
Inches.	lbs.	oz.	Inches.	lbs.	oz.
¾	0	5	¾	0	6½
⅝	0	7½	⅝	0	9½
½	0	14	½	0	14
⅜	1	0	⅜	1	5
¾	1	4	1	1	15
1	2	0	1¼	2	10
1¼	2	9	1½	3	2
1½	3	12	2	4	6½
2	6	1	3	6	14½
			4	9	8

NOTE.—It is not advisable to use iron pipes where they would be covered, or not easy of access.

Gas-Engines.—This section consists of one paragraph asking for notice in order that the gas undertaking may see whether the service-pipe is adequate, and stipulating for an effective check governor or anti-pulsator.

Escapes.—These clauses deal with the question of responsibility, the precautions to be observed in the case of an escape, and the sending of notices to the gas office should leakages occur.

General.—This part has only reference to the authorization of gas-fitters.

Conditions of Supply.—The paragraphs in this section cover the conditions under which meters are supplied and fixed by the gas undertaking; the restrictions as to unauthorized removal or disconnection; the protection of wet meters during frosty weather; responsibility for damage to meter; registration of gas consumed; and the like. The clause dealing with a consumer's own meter, while stipulating that this may be repaired and replaced at the expense of the owner, says nothing as to the necessity of an official test and a certificate before re-use. A previous paragraph under the "Meters" section requires, it is true, the submission of "repaired and second-hand meters at the gas office for inspection;" but this is liable to be missed.

There are several paragraphs dealing with the supply of gas through prepayment meters; the payment of deposits in the case of periodical accounts; change of tenancy; discontinuance of the use of gas; complaints; and similar matters. Among these paragraphs is one exempting the undertaking from responsibility for loss or damage through gas escapes not due to the negligence of their servants, and also giving useful directions as to procedure in case of leakage. This was already dealt with under the heading of "Escapes."

The pamphlet rightly recommends architects, surveyors, builders, and others who may be preparing plans and specifications, to insert a clause requiring all gas-fittings to be in accordance with the gas undertaking's regulations. The brochure as a whole provides a very useful set of gas-fitters' regulations, from which any gas manager for himself may compile a specification covering his own undertaking's requirements; and in this he will, we think, be further helped by the American gas-fitters' regulations which have already been published in our pages (*see* "Journal" for Sept. 1 last, p. 568).

The Lancashire Section are supplying copies of their pamphlet to members of other Commercial Sections; and Mr. S. E. Halliwell, of Littleborough, who acts as the Hon. Secretary, informs us that any of our readers may obtain a copy (at, we presume, a small charge) on application to him. The Lancashire Commercial Section may be congratulated on the work they have done. The above summary will probably give some indication of the service which Commercial Sections generally are capable of, and are, rendering to the gas industry. This is a class of work which cannot so well be undertaken by any Institution, and there are many other examples of like kind. The topics discussed, and the work done, by Commercial Sections are, we know, of a varied character, and the information offered and available in these informal round-the-table gatherings is very frequently of

considerable value. Indeed, the commercial and even technical knowledge thus exchanged is such that it may be safely said that those gas undertakings who fail to send their managers to the district "Section" meetings stand to suffer unconscious loss.

CONCILIATION IN LABOUR DISPUTES.

When noticing a fortnight ago the first portion of the report in connection with industrial disputes in 1907 which was recently issued by Mr. A. Wilson Fox, of the Labour Department of the Board of Trade, it was remarked that an early opportunity would be taken of returning to the volume for the purpose of setting forth other statistics. The section already dealt with related solely to disputes which resulted in an actual stoppage of work; but the remaining part makes more cheerful reading, inasmuch as it furnishes particulars of those of the disputes which terminated in 1907 by conciliation or arbitration, and sets forth the important work done by Conciliation Boards during the year.

It is gratifying to note that the number of disputes settled by conciliation or arbitration in 1907 did not show any falling off when compared with the previous year, while it was considerably higher than in any of the three years before that. The number of workpeople involved was a good deal larger than that recorded for 1906; and, with the exception of 1904 (when the statistics were affected by one very big dispute), it was the highest of any year during the five years ending 1907. Of the 601 disputes which began in 1907, 45 (directly involving 13,452 workpeople, or 13 per cent. of the total directly involved in all the disputes of the year) were brought to a close by conciliation—that is to say, by the mediation of a third party or board—or by reference to arbitration. In view, however, of the fact that in the case of many of the disputes settlements were not arrived at until 1908, while, on the other hand, some which began in 1906 were settled by conciliation or arbitration in 1907, the disputes are tabulated in the report according to the year of settlement, and irrespective of the date of commencement. Though by far the most fitting time for the idea of conciliation and arbitration to be brought to bear upon the relations between Capital and Labour is before an actual stoppage of work takes place, the adoption of the principle even after an outbreak of hostilities is to be welcomed on the ground of "better late than never." Therefore it is pleasing to note that the past two years show so large an increase over immediately preceding ones in regard to the number of strikes and lock-outs ultimately settled in this fashion. In 1903, 29 such disputes were brought to an end by conciliation or arbitration. In 1904, the figure was 28; in 1905, 25; in 1906, 46; and, as already mentioned, in 1907, 45. The number of workpeople affected is not, of course, necessarily proportionate to the number of disputes; but it is the latter which is the most important point to bear in mind in considering the growth or otherwise of any particular methods of settlement. The present report states that during the five years referred to conciliatory methods of settling disputes have been adopted more frequently in the mining and quarrying industry than in any other group of trades. Of the 173 disputes (directly involving 58,261 workpeople) which have been settled during this period by conciliation or arbitration, 52 (directly affecting 16,016 workpeople) occurred in that industry. The metal, engineering, and shipbuilding trades come next with 28 disputes; then the building trades, with 25 disputes; and next the clothing trades, with 22 disputes. Textile trades accounted for 20 disputes, involving 5414 workpeople. Of the 45 disputes settled in 1907 by conciliation or arbitration, 30 were arranged by conciliation, and 15 by arbitration. Nine of them were settled under the Conciliation Act, 1896 (in addition to twenty cases not involving an actual stoppage of work, as against ten cases in 1906). The most important of the arrangements so come to, of course, were in conection with the disputes affecting railway servants on all the principal lines in the United Kingdom, and the cotton spinners in the Oldham district. Permanent Boards of Conciliation and Arbitration settled seven cases last year; Trades Councils and Federations of Trades Unions disposed of four cases; and the remaining 25 were settled by individuals.

So far the figures dealt with have been only those relating to disputes in which an actual stoppage of work occurred; but, as the report points out, the most important function of Boards of Conciliation and Arbitration is not the settlement of strikes and lock-outs, but their prevention, by the discussion and adjustment of differences which under less favourable conditions might lead to a stoppage of work, with its attendant disastrous results on the men thrown out of employment, on the industry concerned, and on the prosperity of the nation. The number of permanent Boards of Conciliation and Arbitration known to have taken action in 1907 was 89; and the number of cases considered by them was 1545, as compared with 1561 cases considered by 93 Boards in 1906. The figures for the two years are thus very much the same in character. Of the 1545 cases considered in 1907, 471 were settled by the Boards or their Committees, and 197 by Arbitrators or Umpires appointed by them. Of these 668 disputes, only seven involved stoppage of work; four of these being in the coal-mining industry, and three in the shipbuilding industry. In 789 cases, the questions in dispute were either withdrawn or settled independently; and the remaining 88 cases were still under consideration at the end of the year. Naturally, the cases dealt with varied in importance. While the Boards of Conciliation for the coal trade of the Federated Districts and of South Wales and Monmouthshire arranged changes in wages affecting 280,000 and 165,000 workpeople respectively, the 241 cases settled by the Durham Coalowners and Miners' Joint Committee involved in most instances only a few workpeople. Mr. Fox remarks that, as usual, by far the greatest number of cases occurred in the mining and quarrying industries; about two-thirds of the total number settled being accounted for by this group. This large proportion is explained by the existence of Joint Committees in Northumberland and Durham to which disputes at individual collieries are referred—these Committees being credited with no less than 374 out of the 454 cases settled in this group. The number of Boards which have settled cases during the past five years, so far as is known to the Labour Department of the Board of Trade, is as follows: 1903, 65; 1904, 57; 1905, 60; 1906, 78; and 1907, 73. Several new Conciliation Boards were formed last year; and, it must also be stated, some ceased to exist. It should be pointed out that there are to be found certain arrangements between employers and workpeople for the settlement of disputes by conciliatory means which do not fall quite within the description of what is usually understood by the term Conciliation Board. Of such a nature are the arrangements in the cotton and engineering trades.

WATER ACTS FOR 1908.

In preceding issues of the "Journal," the principal features of the Gas Acts of the session were dealt with. We have now to notice those relating to water supply—taking first the measures affecting Companies.

By the Holderness Water Act, certain persons therein named are formed into a Company to supply water within the borough of Hedon and adjacent places in the East Riding of the county of York. The capital of the Company is £100,000, in £10 shares; and power is granted to borrow to the extent of one-third of this amount and to issue debenture stock. It is intended to construct a well and pumping-station in the parish of Lockington, in the rural district of Beverley; a service reservoir in the parish of Holme-on-the-Wolds, in the same district; two conduits or pipe-lines; and a water-tower in the parish and borough of Hedon. In the Bill, the promoters asked for seven years within which to complete these works; but the Act has granted them only five. The rates to be charged are to be on the gross estimated rental of the premises supplied; the minimum sum being 8s. 8d. per annum. Closets, beyond the first, and fixed baths are to be extras—not exceeding 5s. a year for the former and 10s. for the latter. Water supplied by measure is to be charged for at a rate of 10s. per quarter when the consumption does not exceed 5000 gallons in that period; but when it does, the price must not exceed 1s. 11d. per 1000 up to 10,000 gallons, and it is reduced for quantities above this limit. In no case is the price to exceed 2s. per 1000 gallons in the case of supplies by meter; water for public purposes to be sold at 6d. less. Authority is granted for the sale of water in bulk and the supply of fittings, as well as for the removal of these and meters. In the Bill, the Company asked to be empowered to purchase from the Urban District Council of Hornsea their existing water-works; and also to sell portions of their undertaking. In the Act, the Company are to afford to the Council, within one year after demand has been made in writing (the demand, however, is not to be made within two years from the passing of the Act), such a supply of water in bulk as the Council may require, at 1s. 6d. per 1000 gallons, or any other price that may be agreed upon; and they are not to supply water in Hornsea without the consent of the Council, and until they have acquired their works. The Withernsea Council may also demand a supply in bulk; and within five years after the passing of the Act the Company are to lay such conduits or pipe-lines to the boundary of the urban district of Withernsea as will enable them to afford a supply of water there. The Act contains a number of provisions for the protection of the Crown, the Postmaster-General, local bodies, and others. [*Parliamentary Agent: Mr. J. Kennedy.*]

The Pontypridd Water-Works and Tramroad Act confers upon the Pontypridd Water Company authority to construct some additional works, consisting of an impounding reservoir on the Afon Llia (another, on the River Neath, was included in the Bill), three service reservoirs, a tramroad, and a number of aqueducts or pipe-lines and other works. The Company may take water from the Afon Llia, the Nant-y-Groes, and their tributaries; and ample provisions are made in regard to compensation, the filtration of water, and the prevention of plumbism. The Llia reservoir works are to be substantially commenced within two years after the passing of the Act; and the rest are to be completed within seven years—compared with fifteen years asked for in the Bill. After Dec. 31 next, the Company are to supply water in certain parts of Llantrisant and Llantwit Fardre if called upon to do so. The charges for water are to be based upon the rateable value of the premises supplied; and the maximum rates per annum and in force during the construction and after the completion of the works are fully set out in a schedule to the Act. On the application of any local authority whose district is within the Company's limits, the Board of Trade may, after the completion of the works, revise these rates. For supplies by meter the charge is not to exceed 1s. 6d. per 1000 gallons when the quarterly

consumption does not exceed 10,000 gallons, with reductions for larger quantities. Meter-rents ranging from 3s. 6d. up to 20s. per quarter, according to size, may be charged. The Company may raise additional capital to the amount (including premiums) of £290,000; and they are restricted to £100,000 in preference shares. The dividend on the former is not to exceed 7, and on the latter 6, per cent. per annum. Borrowing powers are granted to the extent of one-third of the additional capital authorized to be raised; and the Company may create and issue debenture stock. As in the Act already noticed, ample provisions are made for the protection of local authorities and others, including the Aberdare and Aberaman Consumers' Gas Company, who are to have fourteen days' notice of any works calculated to interfere with their mains or service-pipes. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Rhymney and Aber Valleys Gas and Water Act confers upon the Rhymney and Aber Valleys Gas and Water Company power to construct additional works, consisting of an aqueduct or pipe-line and a service-tank in the parish of Llanfabon, in the county of Glamorgan. An extension of time, by three years, is granted in respect of a reservoir and other works sanctioned by the Company's Acts of 1892 and 1898; and the new works are to be completed within five years, which is two years less than was asked for by the Bill. The reservoir referred to is to be substantially commenced within one year from the passing of the Act. Provision is made for the sale of water in bulk and by measure; the price to be charged in the latter case not to exceed 1s. 6d. per 1000 gallons. All water is to be effectually filtered; and the Company are, with all practicable despatch, to increase their filter-beds to such extent as may be necessary, and in any case within twelve months after the passing of the Act. They are authorized to raise additional capital, as mentioned when dealing with the gas sections of the Act. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

The Act of the South Suburban Water Company gives them power to raise additional capital to an amount not exceeding £100,000, to be entitled to 7 or 5 per cent. per annum dividend according as it is raised as ordinary or as preference capital, and to carry borrowing powers to the extent of one-third. Authority is given for the creation of debenture stock. The new shares are to be put up to auction or tender, and those not sold are to be offered at the reserve price to the shareholders, employees, and consumers, in such proportions as the Company may think fit, or to one or more of these classes only. Subject to the consent of the Slough Water Company, a portion of the hamlet of Poyle, in the parish of Stanwell, now served by the South Suburban Company, will be relinquished by them as soon as convenient after the passing of the Act. On and from Jan. 1, 1910, the Company may take water from the Thames and its tributaries, as well as from lands within the watershed of the river, in accordance with regulations as to quantity and payment to the Conservators fully set out in the Act; but they are not to supply water for use outside their limits. [*Parliamentary Agents: Messrs. W. & W. M. Bell.*]

A "late" Bill was promoted by the Camborne Water Company to enable them to raise additional capital to the extent of £25,000. It passed through both Houses unopposed, and received the Royal Assent on the 1st of August.

Gas Engineers as Municipal Councillors.

Those of our readers whose professional work is carried on in the North of England, and especially the section of them who are members of the Association of Gas Managers for that district, will, we are sure, be gratified to learn that Mr. William Hardie, the Engineer and Manager of the Tynemouth Gas Company, who has for the past four years been a member of the Tynemouth Town Council, was on Thursday last unanimously invited by his colleagues to fill the position of Mayor for the ensuing municipal year. Mr. Hardie thanked the members for the heartiness of their invitation, and, in accepting the position, expressed his appreciation of the high honour they had conferred upon him. The Mayor-Elect entered the Council in 1904 as representative of the Trinity Ward, and has worked hard and ably in the interests of the ratepayers—devoting much time to committee work. He is held in high esteem by his colleagues and by every one who knows him; and it is confidently expected that his election will meet with general approval in the borough. In connection with the foregoing announcement, it will be convenient to mention here that Mr. Charles Meiklejohn, the Engineer of the Rugby Gas Company, and Hon. Secretary of the Midland Association of Gas Managers, has been successful in his candidature for a seat on the Urban District Council.

Export of Monazite Sand from Brazil in 1907.—According to a report of the Austrian Consul General in Rio de Janiero (quoted by the "Zeitschrift des Vereines des Gas- und Wasserfachmänner in Oesterreich-Ungarn"), the export of monazite sand from Brazil in 1907 amounted to 4437 metric tons, compared with 4352 tons in 1906. The value had increased in somewhat higher proportion than the quantity exported. Of the quantity exported, no less than 4218 metric tons went to Germany. There was, however, a perceptible increase in the quantity imported into France last year; but to all other countries the importation showed no advance, and was quite small.

ILLUMINATING ENGINEERING IN AMERICA.

[COMMUNICATED.]

THE Second Annual Convention of the Illuminating Engineering Society, which will come to a close the day after these words are written, bears striking testimony to the rapid progress of illuminating engineering in America. At the organization of the Society in the spring of 1906, illuminating engineering as a profession was practically non-existent; and the supreme importance of a proper utilization of light passed unrecognized by the architect, the lighting company, and the light user. The latter indeed often discovered—but generally too late—that certain eye-troubles were due to "eye-strain" (to quote his oculist), but seldom appreciated how many of these troubles were caused solely by improper lighting conditions. However, with the formation of the Society a great interest in its aims was evinced by the employees of the various lighting companies of our largest cities, and by certain companies engaged in the manufacture of fixtures, lamps, globes, and other lighting accessories.

The constitution of the Society wisely provided for the formation of Local Sections. These have been established in New York, Philadelphia, Chicago, Boston, and Pittsburgh; and by affording most of the members of the Society a convenient opportunity for meeting together monthly, they have done much to enlarge the membership—now over 1000—and to increase the value of the Society to the ordinary member. The Philadelphia Section has about 200 members, and the New York Section almost as many. The development of interest in illuminating engineering in Philadelphia is probably typical of the influence of the Society as a whole. The two lighting Companies—viz., the Philadelphia Electric Company and the United Gas Improvement Company, operating the Philadelphia Gas-Works—encouraged their employees to organize the Philadelphia Section. This was just two years ago. In that time, the membership has doubled; a start has been made in securing the co-operation of the architects in the obtainment of proper lighting effects; and (what is of more direct interest to your readers) the employees of the lighting companies, and especially of the gas company, are becoming more and more convinced as to their obligation to show the gas consumer how to make the best use of the gas he buys, not only for cooking and industrial, but also for lighting, purposes. Thus, gas lighting again bids fair to have the attention it deserves. Before the advent of electricity, the gas companies sold gas mainly for lighting, and paid little attention to the needs of the consumer. When the incandescent electric lamp began to find a place in the lighting field, the fuel uses of gas, both domestic and industrial, began to be exploited; and for ten years, at least, gas companies have been devoting thought and money towards the introduction of those appliances best adapted to the fuel uses of gas. In the lighting field, certain appliances (such as burners) have been improved; and the gas company may have distributed free great numbers of flat-flame burners, and also maintained at cost incandescent burners. But neither it nor the companies manufacturing lighting appliances have devoted much attention to the use by the consumer of the light derived from the gas. The gas company has been very careful to ensure the proper sizes of gas-piping; but these sizes have depended entirely on the number of outlets left in the piping—the assumption being that every outlet provided would be made use of. Consequently, it has been to the interest of the builder to keep down the number of outlets; and this has meant putting one, or at most two, in each room of ordinary size. Should the location of the outlet be badly chosen, the user of the light may have no redress save the rather costly course of changing the piping. Also, as the gas company has not been interested in globes or in gas-fixtures beyond an inspection for tightness and certain details of construction, there are to-day millions of rooms in the States where gas is being used for light with results unsatisfactory both to companies and consumers.

As stated before, the Illuminating Engineering Society, in its short life of two years, has shown the employees of the gas companies that the improvement of these conditions should be undertaken at once, and that the reward will be well worth the effort. For instance, suppose in each of a hundred houses a month's free trial is given of an incandescent burner with a proper design of directing or diffusing globe, replacing as a source of light a flat-flame burner, surrounded by its clear or etched glass globe. At the end of such a trial, if no purchasers are found, the entire investment, save mantles only, may be used in other places. The writer, however, firmly believes that many of the appliances would be paid for at the end of the month, and by such an introduction scheme, thousands would be taught what good lighting by gas means, both as to effectiveness and economy; and that by some such way the gas companies will ere long be able to increase their lighting output.

To return now to the Illuminating Engineering Society and its convention. There were four sessions—two on each day, Oct. 5 and 6, at Philadelphia; the meeting days occurring during the festivities of Founder's Week, which celebrated the 225th anniversary of the founding of the City. There were in attendance 254 members and 148 visitors, including many ladies. For the latter, theatre and card parties and automobile outings were provided; and they were also present at the vaudeville entertainment which rewarded the members after their two days of faithful work. There was a small, but interesting, exhibit of the most

modern forms of lighting appliances, both gas and electric, of photometers or colorimeters (*i.e.*, colour measures), and of the colour effects of various illuminants, as shown by the varied appearance of coloured fabrics, subjected to these illuminants, which were effectually shielded from each other.

The meeting sessions were marked with a close attention on the part of the audience to the speakers, and by a gratifying and general discussion of the papers presented. There were sixteen of these, besides the President's Address, and a report on the Unit of Light. In the address, Dr. Bell gave "a study of the problem of street lighting in its broader aspects, especially with reference to the choice and placing of lamps in their relation to effective illumination." The report on the Unit of Light represents work done in connection with the American Gas Institute and the Institute of Electrical Engineers, and will reach your readers through other sources.

To the consideration of the sixteen papers, eight-and-a-half hours were devoted. Of this time, more than six hours were occupied by discussion; and as no paper was read *in extenso*, and the authors in the five to ten minutes allowed for abstracting added to, rather than repeated, the sense of the written words, there was no time when the interest flagged. Many of the papers furnished data of great value to illuminating engineering, and represented in some cases the free gift by the author to his professional brethren of information that a more self-seeking person would have retained for his sole benefit. Naturally then, all agreed with the President in his closing remarks, that the meeting had been very successful and that the future of the Society was assured. A list and condensed description of the papers is given below.

Modern Gas-Lighting Conveniences. By Mr. T. J. Litle, jun.
Describes the various methods of gas lighting ignition by electrical means, pilot flames, &c., with an account of some other special gas-lighting fittings and of a small candle power gas unit.

Illuminating Value of Petroleum Oils. By Dr. A. H. Elliott.
An account of a number of experiments showing the value of petroleum oils as constant sources of light of great reliability, with data of experiments with oils of various densities used in a variety of commercial types of lamps.

Street Lighting fixtures: Gas and Electric. By Mr. H. Thurston Owens.
Street Lighting is divided into five classes, and the methods discussed for securing the best illumination for each class.

Structural Difficulties in Installation Work. By Mr. James R. Strong.
Advocates the laying out of outlets for an office building on the basis not of separate offices, but of each floor as a whole; and for residences on the basis of the darkest probable decoration of rooms, with outlets so located as to admit of any probable changes in arrangement of furniture.

Architecture and Illumination. By Mr. Emile G. Perrot.
The subject is treated under the heads of "Necessary Illumination for Lighting" and "Decorative Lighting," with reference to an example of each case.

Intensity of Natural Illumination Throughout the Day. By Mr. Leonard J. Lewinson.
Gives the result of measurements of illumination from the sun and the moon; the determinations covering the entire range of the twenty-four-hour period, and different conditions of weather.

The Integrating Sphere in Industrial Photometry. By Dr. Clayton H. Sharp and Mr. Preston Millar.
Treats of the theory of the integrating sphere and gives experimental data on the test and performance of large and small spheres in the photometry of arc and incandescent lamps.

The Ives Colorimeter in Illuminating Engineering. By Dr. Herbert E. Ives.
Describes an instrument for the measurement of all kinds of light in terms of three primary spectral colours, with a table of readings for all the various sources of lighting.

Calculating and Comparing Lights from Various Sources. By Mr. Carl Hering.
The physical meaning of the various quantities involved in lighting calculations and the laws applying to them are explained, the formulas put in shape for direct practical application, with numerical examples to illustrate their use in calculating and comparing light from different sources.

The Calculation of Illumination by the "Flux of Light" Method. By Mr. J. R. Cravath and Mr. V. R. Lansingh.
Practical application of a method suggested by Dr. Clayton H. Sharp, whereby the total "flux of light" is calculated in "lumens," and the average illumination of a given plane determined from the number of "lumens" falling on that plane.

Street Lighting with Gas in Europe. By Mr. E. N. Wrightington.
Describes the various methods of street lighting with gas employed in London, Paris, Berlin, Vienna, &c.

Design of the Illumination of the New York City Carnegie Libraries. By Mr. L. B. Marks.
A preliminary paper treating of the lighting problems involved in the design of the illumination of public libraries, and including details of the design of the illumination of the Carnegie Libraries in New York City.

Engineering Problems in Illumination. By Mr. Alfred A. Wohlauer.
A number of engineering problems in illumination are presented and their solution indicated.

Intrinsic Brightness of Lighting Sources. By Mr. J. E. Woodwell.
Treats of intrinsic brightness of lighting sources from the hygienic standpoint and discusses the practical application of this factor in the design of illumination.

Some Experiments on Reflection from Ceiling, Walls, and Floor. By Mr. V. R. Lansingh and Mr. T. W. Rolph.
An analysis of the effect of reflected light from ceiling, walls, and floor—separately and in various combinations—upon the intensity and uniformity of illumination; the analysis being based upon illumination tests of a room equipped with the eight possible combinations of light and dark ceiling, walls, and floor.

The Relation between Candle Power and Voltage of Different Types of Incandescent Lamps. By Mr. F. E. Cady.
The paper establishes that the exponent expressing the rate of change of candle power with change of voltage is not a constant, but a function of the watts per candle; that this exponent differs for different types of filaments, its value decreasing as the watts per candle decrease.

THE IDEAL HOME EXHIBITION.

THERE can be no doubt whatever about it—the Ideal Home Exhibition, organized by the "Daily Mail," which is now being held at Olympia, has "caught on" as a popular show. Judging by the look of things last Saturday evening, the fourteen days during which the exhibition is to remain open will not afford anything like sufficient time in which to exhaust the public interest. Of course, there is something there to appeal to everybody. Those who do not concern themselves with architectural designs, may be keen about needlework designs—or, if not with these, with the products of a model vegetable garden or orchard. The latter, it should be remarked, are to be seen in connection with real grass plots and a real waterfall, and to the accompaniment of crowing by real cocks. If none of these pleases, then at any rate we are all concerned with furniture and household fittings of one kind or another. All this no doubt explains the fact that there was a very big crowd present on Saturday; and, what is more, it was a "paying" crowd. The number of people present rendered it difficult to make anything like a complete survey of the exhibits; but in taking a walk round, we did manage to see one or two things which either had not been fitted up, or escaped notice, at the time of preparing the article which appeared in last week's issue of the "JOURNAL." The Allen Company, of 106, Victoria Street, S.W., are makers of the "Excelsior" gas greenhouse apparatus; and they show samples of the "Fire-Fly" (hot air) tubular stoves and "Excelsior" water-boiler, for use with coal gas, acetylene, or oil. There are also numerous heating and cooking appliances for acetylene gas. The Anti-Tear Patent Washing Machine Company, of 80, Finsbury Pavement, E.C., exhibit their gas-heated washer. Messrs. Davis, Bennett, and Co., of Horseferry Road, S.W., have an attractively fitted up model kitchen, in which is a cooker by the Richmond Gas Stove and Meter Company; and there are also to be seen a selection of Richmond gas-fires, boiling-rings, water-heaters, and radiators. In a corner of the kitchen is installed a gas-heated water apparatus by Messrs. Fletcher, Russell, and Co., with a thermostatic valve for automatically shutting off the gas when the temperature of the water reaches the required maximum and for immediately turning it on again when the temperature of the water falls. Another exhibit on these stands is a pretty little set of copper aluminium-lined cooking utensils. At the stand of Mr. Thomas Potterton, of Balham, in addition to the specialities referred to last week, there are shown some of the Davis Gas Stove Company's steamless radiators, which are attracting a considerable amount of attention; while the Company also have samples of their cookers exhibited on the stalls occupied by some of the petrol gas firms. Messrs. Telephos Limited, of 115, Cannon Street, E.C., have fitted up their stand with a number of working examples of their patent distance gas lighter, which, it may be remarked, can be seen adapted for use with inverted incandescent burners.

Midland Junior Gas Engineering Association.—Last week we reported the proceedings of the first meeting of the Association for the present session; and it may be of interest to give the programme which has been arranged for subsequent meetings. It is as follows: Nov. 14, visit to the West Bromwich Gas-Works. Dec. 12, paper by Dr. W. B. Davidson, on "Measuring, Testing, and Recording;" and the adjourned discussion of Mr. F. J. Ward's paper on "Retort-House Work and Practice," read last Saturday week. Jan. 9, 1909, visit to the Windsor Street Gas-Works of the Birmingham Corporation. Feb. 13, papers by Mr. G. Pearson, on "Pyrometry," and Mr. G. Ball, entitled "Some Practical Notes on Distribution." March 13, annual general meeting; election of officers, &c.; and a paper by Mr. G. F. Twigg, entitled "Notes on the Derby Naphthalene Process." April 6, evening visit to the Earl of Dudley's Round Oak Iron and Steel Works.

PROFESSOR LEWES ON THE MANTLE.

About twelve months ago, the staff of the Gaslight and Coke Company were afforded the pleasure of hearing Professor Vivian B. Lewes discourse on the hygiene of gas; and so pleasurable was the memory of that event, that another visit by the same gentleman fixed for Monday of last week, when the subject to be lectured upon was "The Theory of the Incandescent Mantle," was looked forward to with the keenest interest by those privileged to be present. The lecture took place in the large hall at the Offices in Horseferry Road; and a glance at the crowded rows of chairs showed that there must have been an audience of round about six hundred, while to judge by the burst of applause that followed the conclusion of the lecture one would have imagined that there must have been a thousand pairs of hands at least brought into play. In justification of this apparent discrepancy, it need only be remarked that the lecture was delivered in Professor Lewes's own style, and that it was accompanied by the many interesting experiments (and also some lantern slides) with which he knows so well how to illustrate his points.

Mr. Corbet Woodall, the Governor of the Company, occupied the chair, and, before introducing the lecturer, referred to the sad misfortune that has just befallen Mr. G. F. L. Foulger, the Chief Distributing Engineer, who, as recorded in the "JOURNAL" a fortnight ago, has had to have one of his legs amputated. He remarked that Mr. Foulger was known to all of them, and that it would be a long time before he would be able to return to business. He suggested that they should pass a resolution of sympathy with him in his suffering; and this was at once agreed to by the audience rising unanimously in their places. Continuing, Mr. Woodall remarked that the Company were looking forward with a considerable amount of hope to the results of the experiment they were now making in the training of boys as gas-fitters. These youths would really have a unique opportunity of becoming thoroughly useful men. The Company wanted nothing short of the best; and they were very glad to have Professor Lewes there to show them the road to perfection.

Professor Lewes, who was cordially received, then proceeded to deliver his lecture, which, with the accompanying experiments, was followed closely by his large audience. He commenced by remarking that some twenty years ago he attended at an office not very far from the spot where they were then assembled, for the purpose of witnessing an experiment by a German student in something new in gas lighting. He then saw used some small cambric caps, the first five or six of which at once fell to pieces; while four or five lasted a little longer. The latter burnt for a few minutes, and then, on a door being opened, they followed in the wake of their predecessors. Little did those who were present at the experiments imagine that they were assisting at the rise of a planet which would flood with light the whole universe. That German student was Welsbach; and the caps were the precursors of the mantles which had been the saviour of the gas industry. The developments of the 23 years that had elapsed since then had shown them what small beginnings might lead to. The theory of the incandescent mantle, however, was a thing that very few people knew much about. An immense amount of work had been done on the luminous flame; but much more had been done on the incandescent mantle. The mantle really came in three stages. In 1885, Welsbach first got the idea of making the mantle; in 1886 he discovered the basis thorium; and in 1891-2 there was the still greater discovery, which converted what had before been a miserable commercial failure into one of the greatest successes the world has ever seen—the discovery of what it was in the mantle that caused the large amount of light, and how this light might be secured.

The first form of incandescence was the lime-light, invented in 1826 by Gurney. This became a commercial success, and was used by Drummond, who was then making a survey of Ireland, and who wanted some very high points of luminosity in order to fix his distances by. As long ago as about 1830, the Municipality of Paris attempted to light their streets by incandescence. They realized that the smaller the object to be heated, the less was the amount of heat required to raise it to an incandescent temperature; and therefore they took little buttons of zirconia, and fixed them on gas-burners fed with oxygen. The cost, however, was so great that the system was soon abandoned. In 1845, a French manufacturer named Gillard put up a big water-gas plant in connection with his iron foundries at Narbonne, and supplied the gas to his workmen's cottages. He made a little mantle out of fine platinum wire. It gave a very creditable light; but after about a fortnight the light emitted began to decrease, because the gases gradually eroded the surface of the mantle. About once in every five years since, this mantle has been brought out again, in the shape of the "unbreakable mantle," with the same result. At one time, however, the platinum mantle really looked as though it was going to be a success. In the eighties, the idea was taken up by Mr. Sellon, of Johnson and Matthey, and they brought it to a wonderful pitch of success. But after a certain time, the old trouble asserted itself. One often heard slurs cast upon English commercial methods; but he (Professor Lewes) always thought of the history of Sellon and that mantle with the greatest degree of pride and satisfaction. Sellon had sold the rights in the mantle to a big American Syndicate; and he—not they—discovered that after three or four weeks' use the mantle began to give an unsatisfactory light, and then without hesitation the whole of the money was paid back to the Americans, and not a single murmur was made on the subject. This was an example that might well be copied by many other people.

Reference was next made by Professor Lewes to the revolution caused by the invention in 1852 of the bunsen burner, which had really been the basis of the success of incandescent lighting. Bunsen was then fitting up those chemical laboratories at Heidelberg which were afterwards to give so much to the world; and he was troubled very much regarding the methods available for heating the vessels. He desired to secure some means that would not cause blackening of the crucibles. Working with him was a young assistant, who was at present Sir Henry Roscoe; and he, remembering the experiments resulting in the production of the miners' safety lamp that had been made by Davey some forty years before, reminded Bunsen of the fact. Roscoe said that if the same principle could be applied to the laboratory burners, the problem would have been solved; and the result was the bunsen burner. It was a discovery which, in its influence on the future of gas, was almost as great as, even if it was not greater than, that of the mantle itself. What was their atmospheric burner to them now? It gave them the power to make gas not only the best of all lighting media, but also the best of all heating media; and thus, by levelling up the load, it made gas manufacture infinitely more satisfactory and infinitely more profitable than it could otherwise be. These Heidelberg laboratories also gave them the mantle, because it was there that Welsbach made his great discovery. After 1852, very little was done until the early eighties, when the movement took place which led towards the coming of the true incandescent mantle. About 1883, Clamond introduced his mantle of magnesia rods in the form of a basket, which was suspended over the burner. It gave a fair amount of light—from 3 to 5 candles per cubic foot of gas consumed; but it never had any commercial success, though he believed there was a small company floated upon it, and samples were largely shown.

In 1885, however, came the first of Welsbach's great discoveries. He was working in Bunsen's laboratories at Heidelberg; and one special line of research always being carried out there was in connection with the rare earths. One day a beaker containing a solution of one of these rare earths boiled over. It was supported on a piece of asbestos card which had the edge ravelled; and as some of the oxides flowed over, Welsbach noticed that the asbestos fibres glowed with great effect. Taking the idea from this, he began to wonder whether it would not be possible to utilize this high degree of incandescence. He experimented with cotton fabrics soaked in the nitrates of these rare metals; and then it was that he brought over here those caps which had already been referred to. The method of making the mantle was improved; but the materials used were of no practical use whatever. First he tried lanthana, which gave an excellent light, but absorbed moisture and carbon dioxide to such an extent that after a few days the mantle crumbled away. Then he tried mixtures, and took out the 1885 patent, which was a dismal failure. In 1886, he discovered that the oxide of the metal thorium gave him a better resisting mantle; and he patented it. He imagined thoria had the power of emitting much light; but in reality it was the impurities in it that gave out the light. The mantles used to vary greatly in illuminating power; and a little later on, in 1891 and 1892, he discovered what it was that caused these discrepancies. He found that thoria itself, when made into a mantle, instead of being the most highly incandescent of all the oxides, gave no light at all, and that the light was caused by the presence of small traces of foreign oxides When absolutely pure, it gave just ¼ candle per cubic foot of gas. Mix it, however, with a proper proportion of other material, and the light was obtained. The oxide of the metal cerium was found to be the best agent; and the addition of about 1 per cent. of it to 99 per cent. of thoria gave the most wonderful lighting power. But directly the ceria exceeded 2 per cent. the candle power fell so fast that with 10 per cent. of ceria added, the mantle gave no more light than one of pure thoria.

This fact was one of the most troublesome things to explain; but various partial explanations were offered. One was brought forward by Bunte in the early days of the discussion. He said the luminosity was very largely due to what was known as catalytic action—that on the surface of the mantle the air and coal gas were condensed together in such a manner that a temperature higher than that of the flame resulted. He would show by experiment that there were grounds for this assumption. This catalytic action, however, only took place at a certain temperature. It was necessary to get gas and air mixing on the surface of the mantle if the best light-effect was to be obtained; and this was a great proof that Bunte was right. Three years ago, however, he (Bunte) gave up the catalytic theory, and took up the idea that the reason why the mantle gave such an intensity of light was because the light was emitted almost entirely in a particular portion of the spectrum. If it was the ceria that really caused this, why did not the addition of still more ceria produce a greater effect? The moment, however, that they got past 1 per cent., the light began to drop, until with 10 per cent. of ceria and 90 per cent. of thoria the light was about 3 candles per cubic foot. No one had pointed out the reason for this; but the nearest solution was some beautiful experiments made by M. Féry, who showed that ceria had a wonderful power of radiating heat.

A year ago, he (Professor Lewes) thought he was going to make a fuel of great value for gas-stoves—that by mixing ceria with the ordinary gas-stove fuel, they would get an amount of heat radiated at least 20 per cent. greater than from any material

before. But he soon found out his mistake. All the time he had his ceria in a very fine state of subdivision (as in a mantle), the heating effect was very great; but when he came to make it up into a mass, this radiating effect almost entirely disappeared. If they got 2 per cent. more heat than with the ordinary material, they were lucky; the reason being that they had to heat the whole mass up to a certain temperature before the radiation came into play. Thoria radiated very little, and ceria a great deal. If they took ceria and heated it up to the right temperature, it gave an enormous amount of light; but it was necessary to heat it up to a temperature of between 1500° and 1600° C. in order to get this effect. Below this temperature the heat radiation was so great that the higher degree was never reached.

The secret of the Welsbach mantle was, first, that 1 per cent. of ceria in the mantle could be heated up to a temperature of 1500° C., and was a marvellous heat and light radiant; but when this percentage was passed, it was so good a heat radiant that it cooled the mantle down. Add to this the fact that there was undoubtedly in this mixture the catalytic action to which he had referred, and that the light emitted by the mantle was over the yellow and green portion of the spectrum, and in these three facts they had the secret of the wonderful performance of the mantle. This theory, he thought, was the only one which met the various factors.

In conclusion, Professor Lewes traced the numerous alterations made in the mantle since its first inception, and gave a brief sketch of the many famous attempts that were made to get round the Welsbach patents. He pointed out that "Sunlight" mantles were the first of the collodion series; but it had now been found that ramie, in the form of fibre, could be made at an extremely cheap rate into beautiful mantle material, with practically the same lasting powers as collodion.

The applause with which the lecturer was rewarded on resuming his seat having subsided,

Mr. J. D. Walker, K.C., said that, as the Governor had been obliged to leave, it devolved upon him to propose a hearty vote of thanks to Professor Lewes for his lecture. Professor Lewes was a remarkable man. In the first place his experiments always succeeded and proved the point that he was talking about—which was not invariably the case with lecturers. And there was another thing which did him infinitely more credit, and added much more to his reputation—that he had persuaded the audience that they understood the whole thing from first to last. He did not think better testimony than this to the success of the lecture could be wanted.

The vote having been accorded,

Professor Lewes, in returning thanks, said he hoped that what he had that evening brought forward would be the means of giving his audience a greater interest in what was one of the most beautiful discoveries of the latter half of the last century.

AN ADDRESS ON SMOKE.

THERE was a crowded attendance of members of the Association of Engineers-in-Charge at St. Bride's Institute, E.C., on Wednesday last, at the opening of the session. The President for the year is Mr. James Swinburne, M.Inst.C.E., F.R.S.; and the business of the evening consisted of the delivery by him of his Inaugural Address. The subject chosen by him for the purpose was one that had peculiar interest for his audience, which was, of course, mainly, if not entirely, composed of men having charge of power plants of one kind or another. That is to say, he spoke on the question of "Smoke" in its different aspects—causes and prevention.

There were, he said, two sorts of smoke to deal with—tar smoke, caused by distilling volatile constituents of coal, and not burning them properly, and lampblack smoke, caused by burning the volatile portions in flames, and letting the flames come against something which choked them, and separated lampblack. When bituminous coal was thrown on to a fire, the first thing that happened was that it gave off about 30 per cent. of its weight as volatile material. The composition of the volatile matter depended on the temperature at which the coal was distilled. The coal itself did not burn until it was at a bright red heat, which was after nearly all the volatile matter—except perhaps a little hydrogen—was given off. He did not mean that there was no combustion until the carbon of the coal was red hot; but what burnt before the coal reached this temperature was not really the coal, but the jets of gas and inflammable vapours escaping from it. As soon as coal was put on a furnace fire, there was a layer of cold fuel being heated from below, and the volatile constituents being distilled off. The cold coal itself cooled the gases coming through the fire; and the result was that large volumes of gas, full of tar smoke, were carried forward. Now, the question was how this tar smoke was to be burnt. It seemed to him that the only thing to do was to raise the whole of the gas containing tar to such a high temperature as to ensure complete combustion. It was not easy to see how to raise the tar to the necessary temperature; but it did not appear to be impossible. If the fire were itself in a fire-brick chamber, and the gases had to pass over a reasonable amount of white-hot fire-brick before any attempt was made to abstract the heat, it was quite possible there would be no smoke, even with a hand-stoked fire. The general principle in furnaces appeared to be to abstract heat from the fire and gases at the earliest possible moment. This he believed to be entirely wrong; and he suggested that the proper way was to abstract as much of the heat as possible from the gases, but to leave them as long as they could before beginning to cool them, and not to heat the boiler by direct action of the fire or even by radiation from it. At any rate, no heat should be taken from the fire, or from the gases, until all the smoke was completely burnt. To make a furnace which would give no smoke, even with hand firing at long intervals, would involve an elaborate construction of fire-brick. Probably a mere flue of fire-brick would not be enough, and it would require something like a regenerator which would get white-hot between each stoking. The simplest way was not to stoke at long intervals by hand. Each piece of coal coming on to a hot fire, of course, gave off smoke at once; but whether the tar was burnt or not, was a matter of temperature and time. Apparently, even if the temperature was high, it took a little time for the tar vapour to be burnt. It might still be important, therefore, to arrange the furnace so that there was no smoke, by means of some method which would keep the gases at a high temperature for a short time. As to automatic stokers, there were plenty of these, all intended to prevent smoke; and many of them were the result of great ability and experience. But the makers never really had a fair chance. The boiler manufacturer seemed to have a fixed idea that the fire ought to be inside the boiler, and the water as close to the fire as possible.

As to this matter, he said: "The idea that the best way to heat anything is to put it into a flame, is very widespread. The bunsen burner is specially designed so that the chemist can put his test-tube right into the flame without sooting it. The spirit lamp is used in laboratories and on the breakfast-table for the same reason. Some of the new gas-stoves are made so that the burner does not play on the saucepan; but it is only after turning out many thousands of abominations that foul the air of a room that the gas engineer has found out this simple thing. Ninety-nine per cent. of the ordinary gas-stoves used for heating rooms are made on this absurd principle, or want of principle. Bunsen burners are used; and proper combustion is stopped by making the flame play on lumps of clay. Whether this produces carbonic acid, or some other deleterious gas, I do not know; but if any of the products of the incomplete combustion of an ordinary gas-stove come into a room, they are far worse than the products from the same amount of gas burnt by bunsen or batswing burners." Returning to his subject, Mr. Swinburne said there was no reason why the furnace should not be outside the boiler. With a shell-boiler, the furnace might be a fire-brick structure in which the combustion was allowed ample room for the hydrocarbons and the air to mix thoroughly, and ample time for the combustion to be complete. The boiler would then be fed with clean, transparent gases. In the case of water-tube boilers, all the furnace-makers wanted was enough room below them, so that the tubes could not possibly begin to abstract heat until the mixture of the gases and air, and the combustion, were quite complete. Electric generating stations were in the most difficult position as regarded smoke, owing to the very rapid variations of load; and yet, in proportion to the coal burnt, they were probably by far the least offenders. This was because they were mostly modern; and probably more attention was lavished on the boilers and furnaces than in any other industry.

Coming to the nuisance of domestic smoke, Mr. Swinburne remarked that it was almost absurd to make laws about industrial furnaces while the ordinary house-fire was allowed. The important fire, from the smoke point of view, was a sort of small kitchen-range, which was used in little houses. This was always going, summer and winter; and the fire had to serve as kitchen and sitting-room fire in winter, and for cooking in summer. These fires smoked during burning, as well as just after lighting. The evil could be reduced by the use of gas coke; but gas coke had many disadvantages. People with little ready-money to spare would not lay in two kinds of fuel; and it was difficult to keep a small fire going with gas coke. The most obvious cure for domestic smoke from all kinds of fire was "coalite;" and another solution was to use gas. Probably the gas companies would soon give up supplying gas which had a high illuminating power in the ordinary sense, as that was rapidly becoming useless. If the gas companies were released from their obligations as to illuminating power, they might supply cheaper gas, which would be used for heating and cooking; and for lighting people would need to employ mantles. This would mean a great saving to the consumer. "The chief difficulty at present," he continued, "is the backwardness in the construction, or rather the design, of gas-stoves. The ordinary gas-stove has bunsen burners, with the combustion interfered with by lumps of clay, as already described; and the burners are made so as to light-back very easily—the jets being inaccessible, and not provided with means of regulation. Most cooking-burners are now being made so that the flame does not play on the pans; but there is still plenty of room for improvement in the ordinary gas-stove. I do not mean to say that there are no good gas-stoves; but there are very few." Heating by oil-lamps, he said, was not satisfactory; "while, at present, from the purely smoke point of view, electrical heating is outside practical politics, as it is not yet likely to become universal in small houses, for both cooking and heating." Smokeless fuel and gas heating, therefore, seemed the only cures now in sight.

The President, in concluding his address, made some remarks upon the importance of keeping a record of smoke emitted. He

said a big firm might think it politic to go on emitting black smoke, or smoke amounting to a nuisance, and pay any fine imposed; but the law provided that the first fine might be £5, the second £10, and so on, in geometrical progression. "The result was," he pointed out, "that if a works went on being fined every week for a year, it might have to pay £22,517,998,136,852,480, and expenses in addition." He told his hearers that he had devised a method of producing photographic records in which the comparison with a smoke scale did not depend upon the observer who took the photograph, but could be made at any time afterwards. This he explained at some length; but at the same time he emphasized the fact that the proper solution of the matter was not to improve the methods of making records, but to stop making any smoke, so that there was nothing to record.

On Mr. Swinburne resuming his seat, Sir Alexander W. B. Kennedy proposed a hearty vote of thanks to him for his address. This was seconded by Mr. Alexander Siemens, who remarked that in Germany it was permissible for all the fires of a house to go into one chimney; and in many cases a large chamber was made. The smoke, rushing up into this, got stopped, and then went on slowly; and the result was that it left in the chamber all—or a great part, at any rate—of the solid particles. The vote of thanks was very heartily accorded; and Mr. Swinburne briefly acknowledged it.

THE "TWEEDIE" BURNER.

ONE more has been added to the number of inverted incandescent gas-burners by the arrival of the "Tweedie," which is a patented article being marketed by Messrs. S. Davis Nicholls, Limited, of No. 56, City Road, E.C., where it can be seen both in action and in pieces by those who are desirous of investigating its claims to favourable consideration by the gas industry. For the benefit of those who are not able to make acquaintance with it in this manner, it may be explained that the "Tweedie" has distinctive features of its own; and that these features are so combined as to produce a lamp which is both ornamental in appearance and effective as an illuminating agent.

Fig. 1.—"Tweedie" Burner for Ordinary Lighting.

The main point about the invention is that it is a strictly regenerative inverted burner; the air supply to the bunsen being heated in an enclosed chamber and tubes by the waste gases, in a manner which will be understood from a glance at fig. 1. The air enters the lower of the two sets of openings shown in the illustration, and passes, by way of the little tubes which can be seen traversing the upper opening, into the closed chamber which constitutes the top of the burner.

Thus the dome, or chamber, is made into a container of hot air—no air can enter it that has not been previously heated. At the same time, the products of combustion pass up in the burner body and escape into the air through the opening which is left between the tubes already mentioned. The fact of the air-intake being situated at a lower level than the point of exit of the products of combustion, prevents the air supplied to the bunsen from being in any way vitiated, so that perfect combustion results. In pursuing the course indicated, it will be readily understood that the air becomes highly heated; and it is said that when the burner has been lighted from eight to ten minutes, syphonic action arises to a considerable degree, with the result that the lamp is made self-intensive without the aid of chimneys or motive power. Means are provided for the perfect regulation of both gas and air.

Fig. 2.—"Tweedie" Burner for Factories, Shops, &c.

The burner is arranged to take standard globes and mantles; and it is made in several forms—all, be it remarked, strong and well finished. A standard mantle can, it is claimed, be maintained at full incandescence with a consumption of from 3 to 3¼ cubic feet of gas per hour—giving an illuminating power, unreflected, of some 90 candles, or from 110 to 120 candle power reflected light. Fig. 2 is one of the patterns specially designed for factory, shop, church, and warehouse lighting. Another form, chiefly for outdoor lighting, has three burners, is wind, rain, and dust proof, is provided with a bye-pass lever, and can be had either made throughout of copper or in enamelled iron. This 3-burner lamp, it may be pointed out, is very suitable for lighting lobbies, &c., and also for shop-fronts where the question of height may have to be considered, inasmuch as it is only about 18 inches long, including the glass.

A NEW GAS-FIRE BURNER.

DURING the past few years, makers of gas-fires have done much towards producing economy by applying to their burners that regulation of the gas and air supply that, considering the scientific laws governing the burning of atmospheric gas-flames, should, it is evident, have been applied from the very beginning of the gas-fire. But nobody seems to have thought much about this, and crudity continued, until the application of refining methods to the adjustment of the proportions of gas and air in incandescent burners proved to all interested that the adjustment had a marvellous effect on flame temperature, and flame temperature on the efficiency of the mantle. If with mantle, why not with gas-fire fuel? It is impossible for gas-fire burners using a mixture of gas and air to be constructed to standard sizes in such a manner that, unaided, these burners will, in all situations and with gases of differing composition, give the maximum possible heating efficiency for the gas consumed. Hence it has come to pass that makers of gas-fires have produced means for properly proportioning the gas and air supply to their burners—Messrs. Wilsons and Mathiesons among them—by the application of the Bray gas and air regulator to their gas fire burners.

But after proportioning the gas and air, what assistance is given by the makers to obtain proper admixture of the gas and air? That is a point to which there has not been a great amount of attention paid, or over which any great amount of ingenuity has been displayed. Messrs. Wilsons and Mathiesons have been looking into the matter, with the result that they have, as was done in the Kern incandescent burner, applied the principle of the Venturi tube to their fire burners, so that the mixture entering the mouth of the burner has to pass through an internal cone-shaped constriction in the entrance tube, then expanding out again in the burner tube (in which are the nozzles) which also internally tapers towards the ends. This change in internal formation has been made to ensure better admixture; and there has been no other alteration effected. Whether the change is sufficient to account for the effects between this and the old form of burner, we are not prepared to say; but the fact remains that, with only this variation in construction, the difference between the flames of the old and the new burners of the firm is extraordinary. The flames are smaller and more concentrated, more regular in height, of better definition, and present all the characteristics that one expects in an atmospheric flame resulting from proper combustion. These characteristics are observable whether the flames be large or turned down to almost the point of extinction. The flames can also be lit with the gas turned on only slightly, without explosion or lighting-back.

These are general observations; but as to the particular useful effects. Sample burners—old and new—were connected for our inspection alternately to the same fire (without fuel) to show the variations in the flames. The ragged flames of the old burner and the well-defined flames of the new showed in striking contrast. With the elongated flames of the old burner, if the gas was turned on with a view to obtaining a greater amount of heat from the fire, users merely found the flames went tailing above the fuel, and thus both gas and heat were wasted. But with the new burner more gas can be used with a lessened air supply, giving a shorter and more solid flame, which has the effect of raising to high incandescence the body of fuel, and utilizing the whole of the heat of the flames. The result is, we are informed, that a 10-inch fire will with the new burner give out as much heat as a 12-inch one with the old burner. Having regard to the effect on flame temperature of the ratio of air to gas within certain limits, the curtailing of the proportion of air to gas in the new burner leads us to ask whether, as a matter of fact, the increased efficiency of the fire is not obtained solely through the concentration of the flame at the expense of the quantity of gas consumed? Or, putting the point another way, Is the heating efficiency as good per given volume of gas consumed? This is only a question that occurs in passing. There is, however, another interesting point. Why is it that, using an additional quantity of gas and a smaller volume of air, the flame is shortened in the manner seen? Any laboratory bunsen in which the air-inlets are closed will give a long straggling luminous flame, which is gradually reduced and becomes more defined, concentrated, and fierce as the air-inlets are gradually opened. There is no immediately forthcoming explanation of these points in connection with the new burner; the firm can only say the effects they obtain are as seen, and can only be ascribable to the change in the interior construction of the burner. The better mixture obtained has apparently altered the necessary proportions of the gas and air.

There is, however, no particular use in speculating; and we must leave the burner, with the final remark that the ability to turn down the gas-flames to a low point without trouble gives to a fire a wide range in heat capability, with hourly consumptions from 6 to 7 cubic feet to about 30 feet in a 10-inch fire. It may be added that there is perfect control with the burner, however the fire is used.

ROUND THE WORLD—AND SOME GAS-WORKS.

By Maurice Graham.

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XII.—SYDNEY, NEW SOUTH WALES.

Entering Sydney Harbour, two bold rocky heads, rising almost perpendicularly out of the water to a height of several hundred feet, keep guard over this beautiful stretch of water. The traveller had heard of the wonders of this city and its surroundings, and was prepared, as he had been told, to see the finest harbour in the world. Slowly the steamer moved through the heads or entrance, and a magnificent sight was met with. It is difficult to describe; but it may be said that the waterway is composed of a series of coves and inlets, measuring on the water frontage 165 miles. Red-roofed cottages and beautiful summer residences are built near to the water's edge, and are surrounded with lovely gardens. Some idea of the scene and of the situation of Sydney can be gathered from Photograph No. 106.

The general plan of Sydney is more like that of an English town than any visited by the writer. The streets are not geometrically laid out in squares or blocks, but retain the shapes that existed from the earliest settlers' days—curving in and out to avoid steep ascents, and thus giving an old-world picturesqueness

Photograph No. 106.—General View of Sydney and Harbour.

to the town. There are many parks; and the public buildings do not fail to attract the attention of the visitor. They are beautifully built in stone, and surrounded with grounds of magnificent foliage. The business part of the city is within a radius of half-a-mile. Circular Quay is the centre of all moving traffic. The electric tramcars all leave and return here; also the wonderful service of ferry boats start and return to this point. The two services work in conjunction one with the other. Thousands of people use these ferry boats daily; and one cannot help admiring the splendid fleet of boats and their organization. The landing stages appear like so many railway platforms, and are all roofed over like a railway station. The writer has, in his travels, seen many ferry systems, but none can compare with that of Sydney. At the time of writing, everyone is looking forward to receiving the American Fleet in the deep-water harbour.

The great difference between Melbourne and Sydney is that the former is built on a perfectly level plain; the latter is built on undulating ground, taking its base from the rugged cliffs forming the foresbore all round the harbour. Inland there are very few flat districts; so the general views of the country are more varied. As regards the railway, that of New South Wales, unfortunately, has a different gauge to the railways of Victoria and South Australia. It, therefore, becomes necessary to change trains on the 18 hours' journey from Melbourne to Sydney. Generally, the railway accommodation and catering in Australia and New Zealand are bad, and far behind those of other countries. The general climate of Sydney is equable. The mean temperature is about 60° Fahr.—in the winter being 50° Fahr. and in the summer 70° Fahr. There is a good average rainfall.

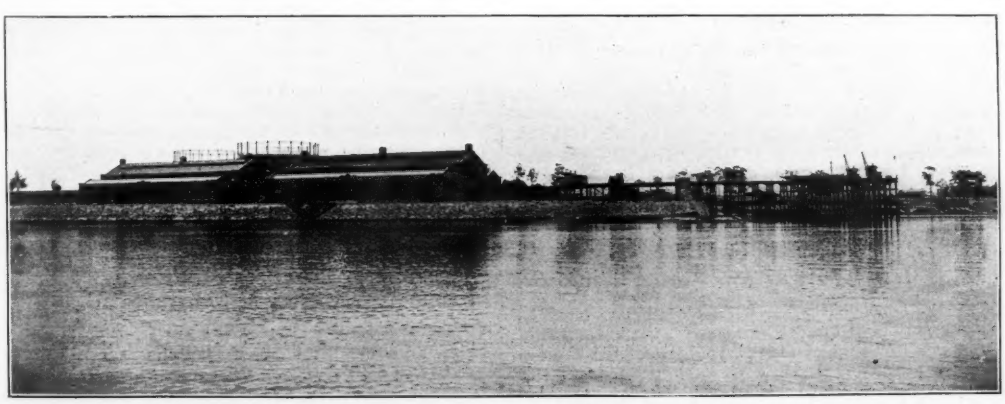
The city and suburbs enjoy the advantages of electric tramways, gas-works, electric light works, good water supply, and good sanitation; so that the general health of the district is well maintained.

THE AUSTRALIAN GASLIGHT COMPANY.

The writer having made a tour of the city and its beautiful suburbs and harbour, wended his way to the offices of the Australian Gaslight Company. He had the greatest pleasure in shaking hands with Mr. Thomas James Bush, M.Inst.C.E., the Chief Engineer and Manager, who had only that day returned to the works after a dangerous operation and lingering illness. He was glad, however, to have a chat about the Old Country and its doings; and although only convalescent, Mr. Bush insisted upon conducting the writer round the head gas-works in the city, and afterwards introducing him to Mr. Robert John Lukey, J.P., the Secretary of the Company. Mr. Bush was appointed to his position in 1878—thirty years ago; and Mr. Lukey, about 24 years ago. So that the Gas Company are fortunate in their chief officers, who so ably and harmoniously guard the Company's welfare.

An Interesting History.

A short history, as given to the writer of this well-managed Gas Company, will be of interest to the gas profession in general.



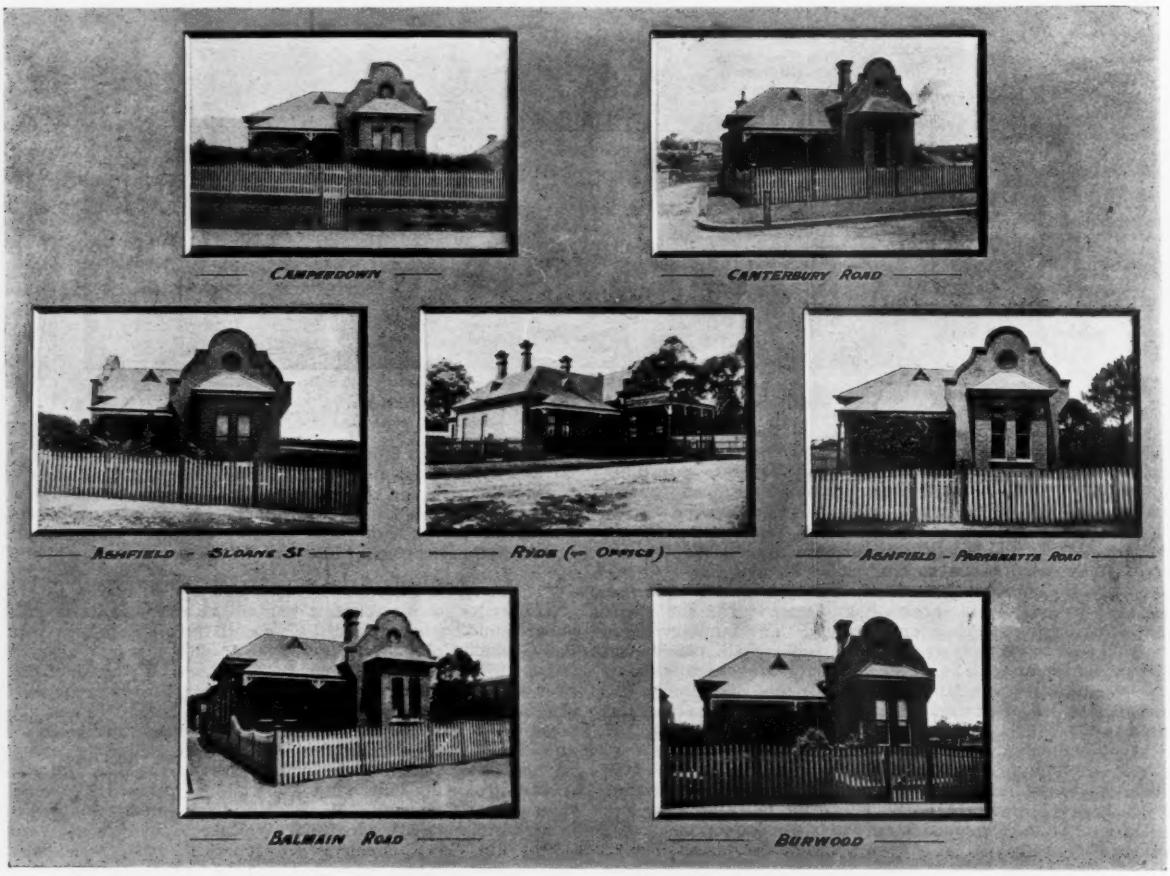
Photograph No. 107.—View of the Mortlake (Sydney) Gas-Works, with Jetty-Cranes, Coal-Stores, and Retort-Houses.

The Australian Gaslight Company obtained their Charter of Incorporation on Sept. 7, 1837. The lighting of Sydney with gas was first under consideration in the year 1826, when at the instance of the Government Civil Engineer, Mr. Alexander Kinghorne, J.P., prepared plans and estimates and calculated the probable return upon the investment. No further notice was, however, taken of the matter until ten years later, when the Rev. Ralph Mansfield founded the present Company. He became its first Secretary, and held the office for 43 years. The selection of the site was the first difficulty; and anyone who has seen the harbour can readily believe that it was like picking the best penny out of a bag of new ones. At length, Darling Harbour was selected; and although the Company's Act was most restrictive, a good start was made. Unfortunately, no photograph or picture remains to record this commencement. The original Act confined the gas supply to Sydney, limited the capital to £100,000, and stipulated that no gasholder should be erected within the town. These restrictions were removed two years later. In 1849 was another Act, followed by yet another which authorized the increase of capital to £300,000. In 1883, another amending Act gave further borrowing powers, not exceeding half the capital then paid up, and raised the authorized capital to £800,000.

Messrs. Bryan, Howden, and Co., of Southwark, London, were appointed Consulting Engineers; and the first consignment of plant for the works arrived in May, 1839. The great distance from England, and the time occupied in transit in the old sailing vessels, proved a trying experience to the Contractors who were erecting the works and caused them unavoidable delays. The same vessel also brought the Chief Engineer of the Company, Mr. James Bryan, who quickly commenced preparing the site and overcoming the many obstacles which fall within the lot of an engineer. It was four years before he was able to announce to the Directors that he was ready to supply gas to the public; and on May 24, 1841, Sydney first saw the new and brilliant light. This was the first time that any town in the Southern Hemisphere had been illuminated by gas-light; and the Press of the day were great in their praise of the public-spirited Company who were soon "to exchange the dim and smoking flames from oil and tallow for the pure, brilliant, and inoffensive illumination of gas."

Referring to this unique event, the "Sydney Morning Herald" of May 25, 1841, contained a leading article of which the following is an extract:—

We have at length the pleasure of congratulating our fellow-townsmen upon the actual improvement in their concerns—the application of gas as an agent of light. Even in England, where mechanical facilities abound, it is seldom that the first night of gas lighting passes off without some interruption, some check to the general joy; but in Sydney, more than 15,000 miles from the manufactories whence all the machinery was produced, everything went on with perfect regularity. The gas was ready at the appointed hour, and no sooner had the sun left the darkness than this new luminary burst forth in the silver radiancy so peculiarly its own.



Photograph No. 108.—District Governor Houses.

On the first night, the number of private lights burning was 181; and in less than a month 685 had been adopted. At this time, the Government had complete control of Sydney and its affairs; but in 1842 a Corporation was established, which readily took advantage of the new gas-light for the purpose of lighting the city, the population of which at that time was 25,000.

The works' site being on a hill-side involved the Company in a large outlay for levelling for the erection of the various buildings. Rock was everywhere; the gasholder tanks (for holders of 45,000 cubic feet capacity each) being excavated out of the solid rock.

Almost immediately after the works were started, Sydney experienced three years of great commercial depression, which greatly retarded the progress of the Company. When this had passed, the City Council led the way with many improvements; and the Gas Company began to feel the benefit of the revival of trade, resulting in extensions of plant. In 1852—the Victorian gold boom—there was a great influx of population; and up to 1861 the works grew rapidly, and a second gasholder at Haymarket Station was erected. By 1865, the storage capacity had increased from 90,000 to 295,000 cubic feet. About 1867, the Directors reclaimed the water frontage of the head station on Darling Harbour, thereby adding largely to the space available for future extensions, which eventually cost £50,000. Among the apparatus adopted, was a steam stoker from England; but it was destined never to shake the nerves of the stokers, as it was lost in the *Walter Hood* on her way to Sydney. It was perhaps as well, as the invention was not a success in England.

Various small works were now run by the Company, so as to accommodate gas consumers residing about the harbour. The maximum daily output during the winter of 1882 was 2 million cubic feet, and the quantity of coal used was 47,000 tons. To-day 203,407 tons of coal are carbonized in the year. The growth of Sydney and its suburbs at this time was marvellous; and the Directors decided that a large outlay of capital would be required to keep pace with it. Eventually, 80 acres of land having been purchased at Mortlake, Mr. Bush took the whole of the work in hand.

Mortlake Gas-Works.

The Mortlake works were started about 1884, and were equipped with all the latest machinery; and only two or three years ago the whole plant was duplicated. A large amount of levelling, excavating, and rock-blasting had to be done; and the stone so acquired was used for reclamation purposes.

Mr. Bush having made arrangements for the writer's visit to

these works, the Gas Company's steam-launch was boarded at their city jetty, and a pleasant trip down the harbour to Mortlake was made. In the distance, a good view of the works is obtained, which is reproduced in Photograph No. 107. Landing at the T-shaped jetty—built of heavy timber, and erected on piles driven into the rock—it was seen that the jetty has two decks, for high and low levels. It is 160 feet long, and ranges in width from 168 feet at the head to 25 feet at the retort-houses. The top stage is 35 feet above high-water mark.

The coal is obtained from the Pelaw Main Colliery, N.S.W. (nearly all collieries in the Colonies have taken the name of some good coal at home). It is a large-sized coal, and gives a good yield of gas per ton—12,000 cubic feet is considered to be only a medium yield for Newcastle (N.S.W.) coal, and more like 13,000 cubic feet is the make per ton with ordinarily good retort-heats, without forcing. The coal is taken out of the vessels by steam cranes, which are going to be altered to hydraulic cranes. It is tipped into trucks, and conveyed to the stores by small locomotives.

There are two retort-houses (as seen in the last photograph) with coal-stores on each side, into which the coal-trucks run and tip. The houses, which are solidly built of brick and stone, of pleasing and serviceable design, are 280 feet long by 70 feet wide by 46 feet high. There are 48 beds of horizontal retorts, comprising 396 through Ω retorts, 20 ft. long by 22 in. by 15 in., all heated on the generator principle. The stage floors of the houses are 10 feet above the ground level—allowing space for coke drawing, clinkering, &c. West's system of drawing and charging machinery is adopted throughout; also for the general equipment of conveying plant for filling the storage hoppers from the coal-stores. It may be mentioned in passing that this Gas Company was the first in Australia to adopt machinery for retort-stoking. At a time when many of the home companies were doubtful of the utility of such machinery, Sydney was proving most emphatically that its advantages were many and great. The heats of the retorts were noticed as being extremely good, and the charges well burnt off. There are no hot-coke conveyors at present; but the writer was given to understand that these will shortly be installed, as labour troubles are so great. In fact, the writer found the Company in the throes of a dispute, which fortunately was settled by a Commission of officers and workmen.

The coke market just now [June] in Sydney is in a bad state, and consequently a large stock of coke is the result. The winter is not severe; in fact the writer would say that the winter month of June is milder than many a May morning at home.

Passing on through the yard one's attention was arrested by the water reservoir cut out of the solid rock. It is about 50 yards long by 20 yards wide; and it was seen that the water-gas tar was finding its way through the crevices of the rock—much to the disgust of the engineers. The water reservoir, which supplies water for all the works' purposes, has a good surrounding catch-water ground. About 60 acres of the land have been, or will be used for the works, and 20 acres for catchwater and water reserve. When full, the dam holds 7 million gallons.

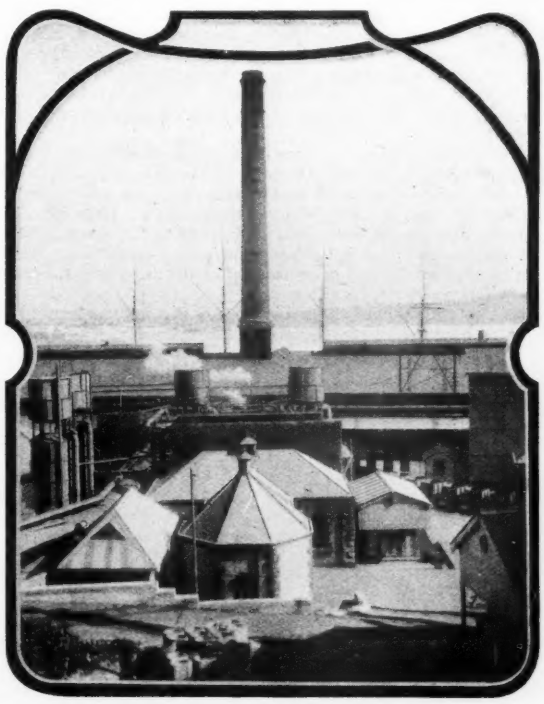
The condensers—by Walkers and Cutlers—are covered with sacking, over which a stream of water is sprayed to keep them cool. In summer, the effect is readily seen and considerable.

The exhauster house is well designed. It contains one Donkin and three Allen exhausters. The battery of washers consists of two "Standard" washer-scrubbers and two Livesey washers.

The sixteen purifiers are in the yard, without cover. They are ranged in two rows; and are 30 feet square, with water seals. Oxide of iron is used; being revivified alongside.

A walk was then taken on to the higher level of the gas-works, where once stood an orange grove. Here are the two telescopic gasholders, one 180 feet and the other 200 feet in diameter, containing together 6½ million cubic feet. The meter-house contains two of Parkinson's station-meters; and the governor house is well equipped.

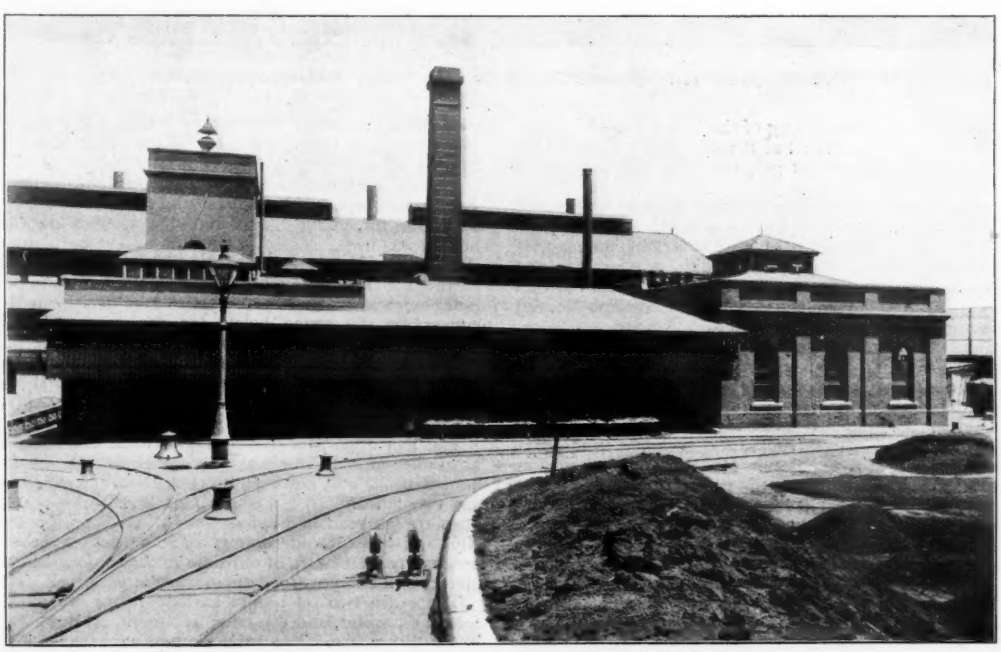
On the way, the Resident Engineer's house was passed, delightfully situated in its grounds. Mr. Stanway is the Engineer



Photograph No. 109.—View of the City Old Works (taken from the Offices).

at the Mortlake works, having been there about seven years. Previously, he was one of Mr. W. R. Herring's assistant engineers at Huddersfield and at Granton during the constructional period. He is responsible to Mr. Bush for the general management of this station, which is the larger of the two Sydney works. His offices are conveniently situated, and the draughtsmen and clerks are well provided for.

There is a splendidly equipped carburetted water-gas plant, which is, however, at present standing idle owing to the fact that oil is at a premium and far too expensive to buy. The plant is



Photograph No. 110.—Another View of the City Gas-Works.

one of Messrs. Humphreys and Glasgow's, and consists of two sets of 500,000 cubic feet each. Ordinarily, one-half of the plant is regularly used.

Turning to bye-products, a sulphate of ammonia plant was seen in operation; but the salt is very little used locally, and is mostly sent to San Francisco. Tar is used locally, and what is left is burned under the retorts. In the Colonies, one cannot afford to stock bye-products as in England, as there is not the enormous market that English gas managers have. Therefore the first idea is to turn everything into money, and profit by the ready market, rather than wait for a rise which may never come.

The general workshops show a master mind, as they are equipped in splendid style with the best class of machine tools. The writer was informed that before these shops were in existence £5000 per annum was spent in repairs done by outside firms, and then not done as required. Now the shop can repair everything necessary at any time of day or night; so that breakdowns are soon remedied. All castings are bought out and worked up as required.

All erection of plant is done by the Company's own men to erection drawings that are sent out with the machinery and material. Also, all new fire-brick and furnace work, as well as general building, are done by the Company themselves. Thus Mr. Stanway, who has been of such great assistance to Mr. Bush in carrying out extensions, has a further opportunity of getting a unique experience of construction on the top of his already good record in previous positions.

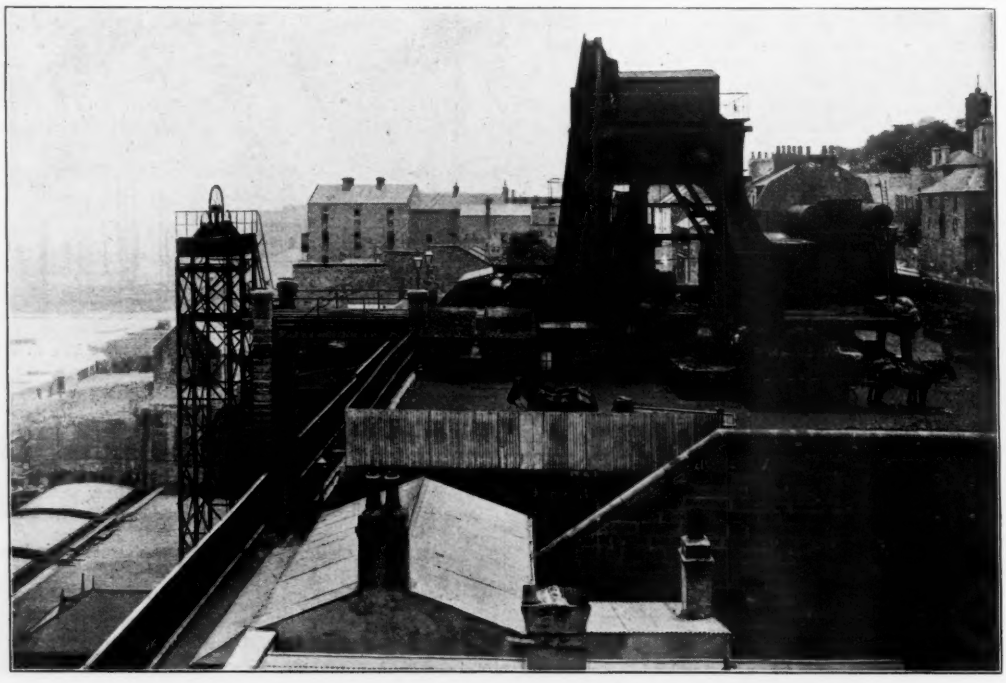
The general scheme of the works all through impressed the writer as having had considerable thought expended upon it and the plans before the first sod was cut. The rock-cutting and general excavation for the gas-works' yard are quite a sight in themselves. The yard is bounded by a cliff 30 feet high, which is part of the solid rock from which the yard has been formed.

Near the gasholders is the "boosting" plant. Mr. Bush decided to boost his gas and introduce a series of governor-houses all over his district. These are shown in Photograph No. 108. This has been a great success. The writer saw the engine-house and gauge for this plant, which registered 12 inches pressure on eight miles of 36-inch diameter main. No trouble is experienced, and the percentage of leakage is in no way increased—the district governors performing their duty thoroughly. After the governors a 3-inch pressure is given to the consumers, which is quite satisfactory for all classes of incandescent burners used. The standard illuminating power of the gas is 17 candles, which is strictly maintained by the Company. Trouble with naphthalene is met with at certain periods of the year.

This finished the visit to the large and interesting Mortlake works, which turn out in the year nearly 1382 million cubic feet of gas, and a maximum daily make of 4 millions.

Head Station or City Works.

The following day a visit was paid to the head station of the Australian Gaslight Company. These are the old original works of the Company, although now equipped with the most modern plant. They were established in 1837; and their area of 5 acres has now all been utilized. In 1894, they became the scene of great activity through the introduction of West's stoking machinery. This entailed the complete reconstruction of the



Photograph No. 111.—Hydraulic Lift for the Coke Trucks. Coke-Screening Plant.

retort-benches, and the remodelling of the interior of the retort-house. The cost was £40,000; but it enabled the Directors to immediately reduce the price of gas, owing to the saving and improvements effected.

The entrance to the Chief Engineer's office is in Jenkins Street, where the first offices of the Company were built. At the present time, they make a suitable suite of offices for the engineering staff, as they are adjacent to, and immediately over, the gas-works—being on the cliff about 100 feet above the yard. A view of the works taken from the office is given in Photograph No. 109, and another view of the works in Photograph No. 110.

The coal used is the same as at the Mortlake works—namely, Pelaw Main, N.S.W. The wharfage accommodation was at first exceedingly limited; but a piece of land was purchased which gave the additional water frontage required. The vessels come alongside the quay, and the coal is discharged by the ships' cranes into light tilting narrow-gauge trucks, and so taken to the coal-stores of about 5000 tons capacity. Mr. Bush is now making some alterations, and contemplates the introduction of coal conveyors for handling the coal from the wharf; and, further, the introduction of conveyors for taking hot coke to the yard.

A walk down the steps from the offices brings one to the two retort-houses which are really one, as they are in one line and under one roof. There are forty-four beds or 308 through horizontal retorts, 20 feet long by 22 in. by 15 in. They are all heated by direct or open fires. An additional house is about to be erected; and Mr. Bush is considering the vertical-retort system. On the present site it is impossible to go down with foundations, as water is found 12 inches below the ground-level. More space is being obtained on the retort-house floor for the stokers, so as to improve the ventilation of the house.

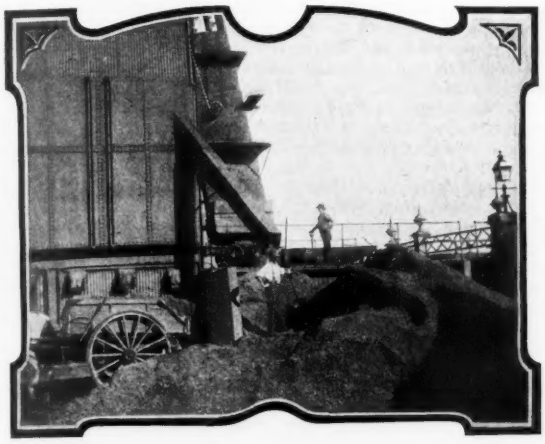
The coke is now quenched by hand buckets and taken out to the yard in barrows. It is then raised in small trucks, by means of a hydraulic lift, to the top of the cliff, where a large coke storage bunker has been erected. This lift and coke plant are seen in Photograph No. 111, which also shows the local coke traffic in carts and bags going on. This system of coke manipulation (adopted by Mr. Bush some years ago) has been the means of conserving the space below for gas apparatus only; and it enabled him to extend these large works in spite of their small area. Another view of the coke-storage hopper is given in Photograph No. 112, showing the coke breeze side of it. The sale of coke is only fair, although the coke is of good quality, clean, and large.

The gas apparatus, generally, is very similar to that at the Mortlake works. The exhauster-house was one of the very first houses built, and contains three of Donkin's exhausters. There are two "Standard" washers and four tower scrubbers. The purifiers (as seen in Photograph No. 110) are situated under the cliff, and are without roofing. The station-meter and governor houses are quite bits of old-time architecture, and contain three meters and one governor of Cowan's latest type.

There are two telescopic gasholders on the works—one 150 feet in diameter, and the other 100 feet. At out stations are four other gasholders. The total storage capacity of all is 2,235,000 cubic feet.

A carburetted water-gas installation of size and make similar to that at Mortlake, and also similar sulphate of ammonia plant, complete these works, which with both sets of the water-gas plant in operation can make 6,200,000 cubic feet of gas per diem.

Before many years, one will see the complete evacuation of the City Gas-Works (the annual output of which is 905 millions) as the land is becoming so valuable, especially as it is almost in the best part of the city.



Photograph No. 112.—Coke Storage Hopper and Coke-Breeze Shoot.

Distribution and Consumption.

As showing the magnitude of the undertaking, the gas-mains pass through forty-one suburban boroughs, covering (with Sydney) an area of 100,000 acres, with a population of 550,000. The number of miles of main laid at present is 924; the pipes varying from 3 to 36 inches in diameter. There are also 1000 miles of special service-pipes, up to 2 inches diameter. The present number of private consumers is 80,000; and there are nearly 11,000 public lights. The lighting of the city was in 1897 altered, in its entirety, to the incandescent system. This conversion cost the Company £10,000, and at the same time was accompanied by a reduction in the price of gas. The writer having thoroughly viewed the lighting, both in the city and suburbs, can certainly vouch for its efficiency.

The gas cooker and fittings department is one which has the particular care of the Directors; and everything is undertaken on a broad-minded principle for the purpose of increasing the sale of gas (which is the primary object of a gas company) and not for the profit to be obtained on the fittings department. Large and well-stocked departments meet the eye; and one can see that this portion of the business is well cared for. The consumption of gas during the day (from 6 a.m. to 6 p.m.) is very satisfactory; being equal to 45 per cent. of the total.

The arrangement by which a consumer becomes a purchaser of a gas-cooker, by a small monthly payment, is greatly appreciated. In this way 16,000 "Eureka" stoves have been sold by the Company, in addition to which stoves of other makers are extensively used. Gas-engines, water-heaters, and gas-fires all add to the increasing consumption.

The penny-in-the-slot meter was introduced by the Company in 1897, and has been a great success. When the writer asked Mr. Bush if he had slot meters in Sydney, the look on the latter's face was expressive of a good deal. The writer then explained that in New Zealand the majority of gas companies only supplied "slots" to those who did not pay their accounts. There is some conflict of opinion and of policy on this question; and it would be interesting to have the right view ascertained. However, the number of houses in Sydney which are, free of cost, fitted up with bracket, pendant, boiling-ring, and meter, is 28,000; and by dropping a penny in the slot, the consumer receives 16 cubic feet of gas, or sufficient to last about three hours.

Some Comparative Figures.

The first meter price of the gas was 25s. per 1000 cubic feet; it is now 4s. It is interesting, also, to state that only twice during 70 years has the price of gas been raised. An old advertisement of the Company's, published about 1840, is interesting. It runs:—

	£	s.	d.
Price of Lights per Quarter—			
Ten-Hole Argand Burner: From dusk till 9 o'clock, 6 nights per week	1	10	0
Ten-Hole Argand Burner: From dusk till 10 o'clock, 6 nights per week	2	0	0
Fifteen-Hole Argand Burner: From dusk till 9 o'clock, 6 nights per week	2	0	0
Fifteen-Hole Argand Burner: From dusk till 10 o'clock, 6 nights per week	2	10	0

If burned on Sunday, add ⅛th.

Comparative costs of lighting were then: With sperm oil, 12s.; with tallow candles, 10s. 4d.; with gas, 5s. 5d.

The public lamps, which were formerly charged at £10 per lamp per annum, are now supplied at £4 5s.; the Company providing the pillars.

The make of gas the first year was 12 million cubic feet; and the revenue from all sources amounted to £12,125. To-day, the latest returns show a make of 2287 million cubic feet, and a total revenue of £486,000.

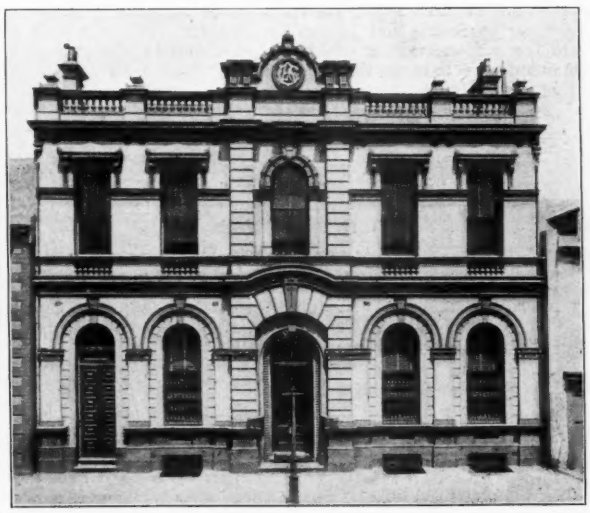
The capital paid up when operations first commenced was £34,600. It now stands at £800,000, with a debenture issue in London of £300,000.

The secretarial staff numbers 147, and the technical staff, 1357—making a total of 1504 employees.

All the clerical part of the undertaking is attended to in the general office in Kent Street, of which an illustration is given in Photograph No. 113.

The social side of the Australian Gaslight Company is a varied and successful one. In the head office are provided dining and smoking rooms, so that the staff are saved the long journey to the centre of the city in the interval for luncheon, besides being ensured a good meal at a low cost in their own quarters. Afterwards reading or games can be enjoyed, and a well-stocked library is at their disposal. The Company's chess club is also well patronized, and many matches played—one by correspondence with the Metropolitan Gas Company of Melbourne's chess club. The cricket club was formed in 1892; and an annual feature is the contest with the electrical firms of Sydney. Thus gas and electricity are rivals in other fields beside that of illumination.

The Australian Gaslight Company (whose Chairman is Mr. George Judah Cohen) has reason to be proud of its position to-day; and as far as the works are concerned, not only are they thoroughly up to date, but, in the opinion of the writer, can compare favourably with works of the same size in the Old Country. With the new extensions about to be made, they will excel them in many instances. This is due to the initiative of the Chief Engineer, who is ever alive to recommend the adoption of any plant or system whereby his Directors will reap the benefit, and the consumers also obtain an advantage, both in reduction of price and improvement in the method of burning gas for light and heat.



Photograph No. 113.—The Australian Gaslight Company's General Offices.

It is only necessary to add that the writer thoroughly endorses the words of the Chief Engineer when he said that the Company's property throughout was in excellent condition. That this is so is due to the Chief Engineer and his excellent staff of officers.

To Mr. Bush and Mr. Lukey the writer wishes to express his hearty thanks for the generous thoroughness with which they accorded him all the information contained in this article, and for the most interesting and pleasant time he passed in their company.

Dissociation Temperatures of Ammonia and Carbon Monoxide.—This subject was recently dealt with by Mr. H. C. Woltereck in the "Comptes Rendus." According to an abstract of the article in the "Journal of the Society of Chemical Industry," a current of ammonia gas was passed, at the rate of 1 litre (at 760 mm. and 15° C.) in 15 minutes, through a tube of Jena glass heated in an air-bath; the temperature being controlled by a Le Chatelier pyrometer. Dissociation of the ammonia was first observed at 620° C. Experiments showed that while pure, dry ammonia does not dissociate below 620° C., the temperature of dissociation is considerably reduced by the presence of traces of organic matter or of water vapour. In presence of metallic iron, ammonia begins to dissociate at 320° C., and in presence of iron oxide at 420° C. Carbon monoxide begins to dissociate at 570° to 580° C.; but in presence of a trace of water vapour, dissociation does not take place even at very high temperatures.

YORKSHIRE JUNIOR GAS ASSOCIATION.

As in all previous years, the annual meeting of the Yorkshire Junior Association, which was held on Saturday, took place under the friendly roof of the Leeds University—a privilege and a distinction highly prized by the members. Some newly-elected members who were attending their first meeting must have felt, as they looked round the handsome library in which they were assembled as welcome guests of the University, proud of belonging to no insignificant Association.

Mr. J. H. HILL (the outgoing President) took the chair at first, and expressed his pleasure in welcoming the members of the Association at the commencement of another year's work. Their membership had increased, and was still increasing; and he ventured to make the same claim on behalf of their usefulness. They had completed a very full year's programme, from which he hoped as much profit as pleasure had been derived. As the report on the year's working was to be presented, he need say no more on this head. They could not assemble that day without remembering the great loss the whole gas industry had recently sustained by the death of Sir George Livesey; and it became them, as associated with the gas profession, to honour the memory of one who had so long been a leading light in the profession, and who had lived so wholly and laboured so strenuously for it. He asked them to join in expressing their respect for his memory and their sympathy with his widow and relatives.

By a silent standing vote, the members passed the proposed resolution of sympathy with Lady Livesey.

The SECRETARY (Mr. C. T. B. Roper) presented his report on the past year's working; and this was adopted.

The Treasurer's (Mr. H. D. Lumb's) financial statement was then submitted; and, after some discussion, and the rejection of a proposal for achieving a minor economy, it was adopted.

As the rules of the Association stipulate that these rules shall only be altered at the annual meeting, the opportunity now arose for incorporating the proposal of the Manchester and District Institution of Gas Engineers for a more intimate connection between the Senior and Junior Associations. The rule dealing with the management of the Association's affairs was therefore amended so as to make the President and Secretary for the time being of the Manchester and District Institution of Gas Engineers *ex officio* members of the Council of the Junior Association.

The ballot for officers resulted in the following elections:—

President.—Mr. H. Butterfield, of Silsden.
Senior Vice-President.—Mr. S. W. Shepherd, of Bradford.
Junior Vice-President.—Mr. F. Scholefield, of Dewsbury.
Ex-President.—Mr. J. H. Hill, of York.
Secretaries.—Mr. C. T. B. Roper and Mr. E. Gillet, of Bradford.
Treasurer.—Mr. H. D. Lumb, of Mirfield.
Council.—Messrs. W. N. Booth, of Huddersfield; W. Cranfield, of Halifax; G. W. Fligg, of Dewsbury; J. Demain, of Otley; and E. J. Sutcliffe, of Bradford.
Auditors.—Messrs. E. Garsed, of Elland, and C. H. Turner, of Mirfield.

The retiring President now formally installed his successor, Mr. H. Butterfield, of Silsden, saying that it was with some measure of pleasure that he laid down the responsibilities of his office, and with even greater pleasure that he handed over the reins to the new President. He had not known him personally till he met him on the Council; but he had since formed a high opinion of him, and was sure that his geniality and intelligence would make his year of office a credit both to him and the members. He had given them an able paper during the past year; and his Presidential Address was being anticipated with keen interest. Incidentally, he would remind any of the members who aspired to this or other office in the Association that they might reasonably be expected to prove their ability and value in the same way by contributing to the proceedings.

In responding to the hearty welcome accorded to him, Mr. BUTTERFIELD thanked the members for the honour done him, and assured them that he fully realized its responsibilities; and while he could promise them his utmost endeavours in carrying out the duties of his position, the contemplation of the list of his predecessors, and the knowledge of how well they had filled the office of President, was somewhat disheartening to one so young as himself. He felt that the members had more confidence in him than he had in himself. Before the advent of the Association, he used to think how lonely a life a gasman's often was, with perhaps only a very few in the same town whose work was in the same direction, with few opportunities of meeting the men he would like most to meet and discuss the problems of his daily business with, and with very limited means of finding help on these problems. Now in their Association they were banded together for mutual assistance and instruction; and the very variety of the offices filled by the members should be a guarantee for the fulfilment of this purpose. He hardly thought they had yet adequately exploited the varied experiences and occupations of their members. There seemed to be an undue modesty and reluctance on the part of many to come forward and add to the general stock of knowledge; and he would point out that even a brief account of some happenings which might appear as insignificant to those concerned, might yet be of very real benefit to others—perhaps even less expert—who might have to face the same contingencies. He really did plead for more readiness in laying aside hesitancy and mistrust of oneself, in order to realize the obligations of Association membership. This was the more to be insisted on because the other advantages of membership were so obvious, and demanded some further recognition than the mere honouring of the Treasurer's call for a subscription. His meaning was clear if he simply reminded them of the incalculable boon of the opportunity of visiting works, &c., which would hardly be open to them as isolated individuals, of their library, and of the notable series of eminent men who had delivered their annual lectures.

A vote of thanks to the officers of the previous year was passed, after laudatory speeches by Messrs. M'Nab and Demain, and acknowledged by the ex-President, Mr. Hill. A further vote expressed the Association's gratitude to the University authorities for their kindness in granting the use of rooms for the meeting and lecture.

The members then adjourned to the Chemistry Lecture Theatre, where Mr. WALTER HOLE had, in readiness for his lecture, hung up a large variety of charts and diagrams, and covered the lecture table with an assortment of models, specimens, photographs, plaster-casts, &c.

In introducing the lecturer, the PRESIDENT referred to the many directions of a gas manager's activities, to the difficulty of excelling in all of them, and to the consequent specializing of some men on separate phases of the work. On this occasion, they were privileged to be addressed by such an expert—one whose recent book on "Gas Distribution" had made his name almost a household word in gas circles, and had proved him as a worthy successor to the eminent men who had honoured them by lecturing at their annual meetings.

THE LECTURE.

Mr. WALTER HOLE then delivered his lecture, as follows.

OUR DISTRIBUTORY SYSTEMS: TWO MODERN DANGERS AND HOW TO MEET THEM.

I desire at the commencement of this address to thank you for the opportunity of taking part in your deliberations, and to assure you of my appreciation of the honour of being asked to open your Winter programme. I look upon the growth and work of the Junior Associations as one of the happiest auguries for the future of the profession. Just as "iron sharpeneth iron," so these opportunities of discussing together common problems and common difficulties, with each member bringing his own contribution to the common stock, cannot but result in the production of men admirably equipped for the duties and responsibilities which lie before them. I am especially pleased that the various matters connected with distribution find a place in your syllabus. Up to a very few years ago, this department was undoubtedly the neglected child of gas engineering, though more recently its importance has been increasingly realized. To-day distribution is coming to her own, as witness the new departure in technological examinations. Everyone nowadays feels that supply has its own peculiar problems, different from, but equally important with, those of production, and that the exigencies of competition, and modern conditions generally, demand that these should be studied and grappled with in the very best possible manner.

But it is not in connection with gas distribution problems generally, but of two in particular, that I wish to speak this afternoon. These I have termed "two modern dangers to our distributing system." The first of these is the danger involved to our system of mains in the terrible amount of vibration to which they are now subjected. The full extent of this evil has hardly begun to be realized as yet. How many of us pause to consider, as a lumbering traction engine with its heavy load rumbles past us in the public street, shaking the very ground beneath our feet, how adversely these tremors are affecting the gas and other mains lying in the subsoil? I have often been simply astounded to find the extent to which these vibrations are communicated to the mains. On one occasion recently, when we had a few lengths of 14-inch main open, I stood upon the main during the passing of a tram-car. The extent of the vibrations was almost incredible; and if that was so in the case of a smooth gliding electric car, how much more must the mains be affected by some of the other heavy traffic of our public roadways?

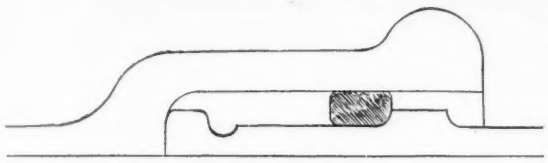
The question then arises: How may this evil be met? There are three ways at least. First of all, the method which most naturally suggests itself is that of laying the mains at a sufficient depth to neutralize the surface vibration. But, in addition to the consideration that it would be practically impossible to take up and relay the whole of the mains in a town, even in new work this is not always possible, because of underground structures such as water-mains, sewers, drains, telephone and telegraph cables, to mention just a few; also, even if the subsoil was otherwise unoccupied, the increased cost for excavation, new attachments, maintenance, and repairs would be very heavy. In the case of mains already laid and new ones which were perforce laid comparatively shallow, and which could not be taken under the footpath, I have found a coating of concrete around the pipe of great service.

In the second place, the evil may be met, as far as new work is concerned, by substituting for our rigid cast-iron pipes others of greater resilience. Hence one reason for the use of steel instead of cast-iron for pipes. This meets the evil in two ways. Being flexible, the pipes take up and dissipate vibrations without

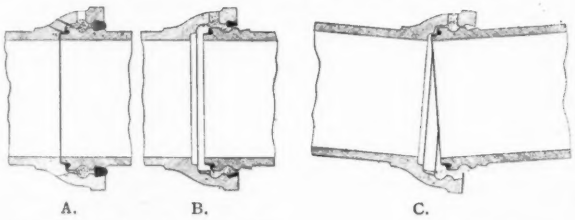
harm to themselves; and by being usable in greater lengths, and so reducing the number of joints by at least two-thirds, they diminish proportionately the number of points at which the vibrations most readily result in leakage. By a recent improvement in the form of the joint, a still further safeguard has been introduced. It is obvious that the mere reduction in the number of joints, while excellent so far as it goes, still leaves the remainder subject to the same stresses. The "Parkinson Rigid Joint," as it is called, is so constructed as to enable the pipe to convey vibrations from length to length without at all affecting the jointing material.

One point which has occasioned some misgiving in regard to steel mains has been the assumed difficulty of making satisfactory service connections owing to the thinness of the wall of the pipe. Whatever of substance there may at any time have been in this objection, is now fully met in two ways. In the first, the wall of the pipe has been very materially strengthened upon opposite sides, with the result of giving for the service attachment twice the depth of thread previously possible. The second method is that of riveting the end of the service upon the interior of the main. This is accomplished by drawing a mandrel through a specially prepared nipple after the latter had been screwed into place. [The lecturer explained the process fully from model.] There are, however, two obvious disadvantages in this arrangement. The screwing-up of subsequent lengths of service, unless very carefully done, must tend to release and loosen the riveting action. Again, in the event of enlargements or repairs being required, the original nipple could not be removed.

For those who have a prejudice against the use of steel mains, and prefer the thicker and clumsier, but more durable, cast-iron pipes, there are several special types of joint available which are of great flexibility. I will take just three only of these. I have here a small model of the Forster joint. This consists of a socket



Forster's Joint, Showing the Compressed Rubber Ring.

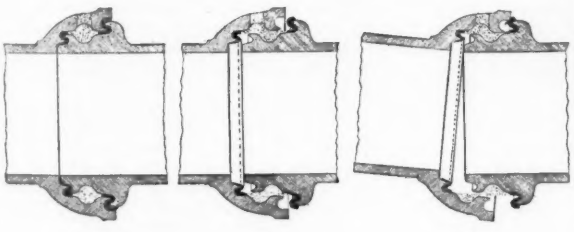


A. B. C.

A. Section of 7-inch Joint under Test.
B. Joint under Test withdrawn ¾ inch.
C. Joint under Test. Pipes deflected 8⅜ inches.

} Air-tight at 40 lbs. Pressure.

Yarrow's Patent Jointed Pipe.



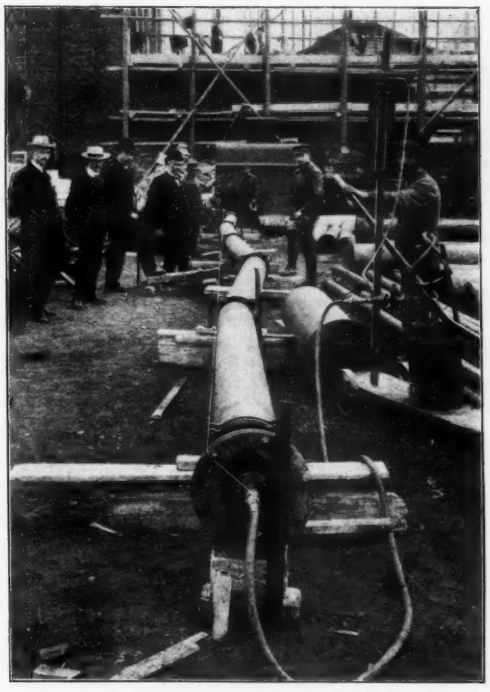
A. B. C.

A. Section of 7-Inch Joint under Test. B. Joint under Test withdrawn ¾ inch. C. Joint under Test deflected 8⅜ inches.

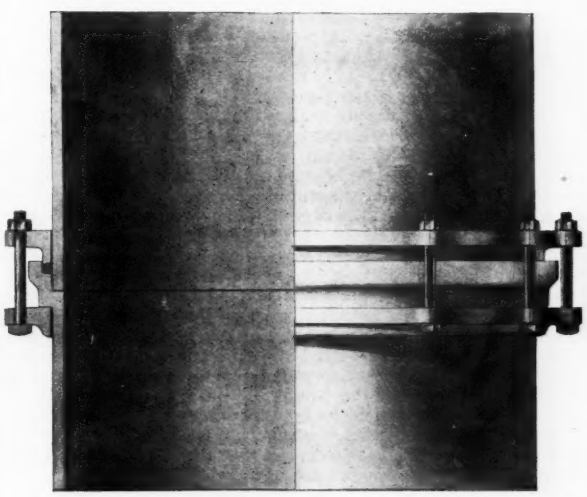
Yarrow's Jointed Pipes—Old Patent.

and spigot somewhat similar to those in ordinary use; but the joint is made by a circular rubber ring being forced into place at great pressure. After being forced home, the rubber ring takes on the oval form, owing to the great compression to which it is subjected. This joint I have found from experience will take up a very considerable amount of vibration, sagging, or deflection without harm. As some doubt has been thrown upon the durability of the rubber ring used, you will be interested in one I hold in my hand, which has done duty for over a quarter-of-a-century in a main used for benzolized gas, and which was only taken out because the demand had outgrown the capacity of the main.

The second joint to which I wish to draw your attention is the rubber joint used on the trunk mains laid from the gas-works at Gennevilliers to the suburbs of Paris. [The lecturer explained the use of the joint from the wall chart.] Every pipe joint must be very accurately centred; and the rubber ring gives a great degree of flexibility, enabling the joint to yield to earth tremors, subsidences, or loading, without in the least impairing its capacity to withstand considerable pressures. In the particular installation mentioned, the pipes ranged from 500 to 1000 m.m. in diameter, or 19·6 to 39·3 inches. While the mains were being laid, each day's work was tested at a pressure of 12 to 18 inches head of mercury, equal to 6 to 9 lbs. per square inch. In the photograph before you, taken at Strasbourg last year, you will observe how the joint lends itself to deviation from an exact straight line, and is a good illustration of the suppleness obtained in its use.



Testing Rubber-Jointed Mains as Laid at Strasbourg.



The Cavallier Pipe-Joint, with Rubber Ring.

The last with which I shall trouble you is the latest and most novel type of joint patented by Mr. Yarrow, of Bolton. In place of the usual parallel spigot and socket, the joint consists of a core into which is run (through a hole in the top of the socket) the jointing material, of either cement or a special jointing composition. I have submitted this joint to some very severe tests, and find it of great flexibility. It accommodates itself to any reasonable amount of subsidence, and is very strong and cheap. When the trench is ready, two men can lower twelve 3-inch pipes into position and run all the joints, within an hour. One quite incidental advantage is that, the jointing material being a non-conductor of electricity, each pipe is perfectly insulated at the joint, and no current can possibly travel by such a main.

This leads by a very natural transition to the second of the dangers of which I wish to speak this afternoon—namely, that arising from wandering currents of electricity. This is undoubtedly a subject which must increasingly occupy attention and demand our careful study. It is an evil which is stealthy in approach, silent in action, and destructive in its effects. At the outset, it is necessary to clearly differentiate between fusion by electricity and electrolysis. These two are widely different in their origins; and vastly different in their results. Fusion is caused by a fault

in the cable giving rise to the production of an electric arc of extremely high temperature. This quickly burns a hole completely through the wall of any iron pipe in its immediate vicinity. Now the cause of this damage is such a fault in the electric system that it must be immediately detected. It is extremely rapid in its action, and very limited in its extent. The results are well defined, and cannot be confused by any intelligent person with any other form of injury to mains.

In the case of electrolysis, both cause and effect are very different. Most, if not all, the trouble arises from leakage of current from the electric traction systems which are now so common in our large towns. To understand how this comes about, it is necessary to remind ourselves of a few elementary facts in connection with the working of an electric tramway.

Taking as an example the simplest case, the current is generated at the power station, and sent along the trolley wire. From this it passes downwards to the car and motor, and thence, by means of the rail, back again to the generating station. In order to lessen the electrical resistance at the junction of the rails, they are carefully attached by means of fish-plates of sufficient section, or welded by means of the "Thermit" joint, and then further bonded by means of copper rods. In addition, the current is assisted on its return journey by means of a system of return feeders varying in number and size with the extent and complexity of the tramway system. The object of these return feeders is, of course, to keep the potential in the rails low and provide an insulated return for part of the current.

Suppose, now, that at some point remote from the power station there are gas or water mains in the near vicinity of the rails. These would certainly be at a lower potential than the rails; and whatever the difference of potential may be, there is a corresponding tendency for the current to leave the rail—its own legitimate path—to travel by means of the mains. These are frequently of large cross section, and provide a comparatively easy route back to the neighbourhood of the power-station. Arriving there, the current would leave the main to take the line of least resistance back to its starting point.

In actual practice, however, the return is seldom if ever quite so simple as this. The joints along the line of pipes are not all equally good conductors. In its return to the generating station, the current may meet with a joint or joints of high resistance. In this case, the current may leave the pipe and pass back again to the rail to resume its own original and legitimate path. Or part of the current may jump the joint, passing round it through the earth to resume its journey again in the pipe, while a portion only returns to the rail. It is obvious, too, that these operations may, under certain conditions, be repeated many times *en route*, passing frequently from rail to main and *vice versâ*. In the case of water-mains, it may, and does, happen that the water contained in the pipe provides a path of less resistance than either the joint or the earth surrounding it; and in that case the current will jump the joint on the interior of the pipe.

Now we want clearly to realize that no harm is done at the point where the current enters the main. Neither is any injury caused to the pipes by the current travelling along them. All the damage is done at the point or points where the current leaves the main. The question here naturally arises as to how the damage is caused. This is not the occasion, and I am certainly not the person, to attempt a dissertation upon electro-chemical reactions and equivalents. I will therefore content myself with the illustration, often used, but at the same time simple and easily understood—that of electro-plating. In this operation, the object to be plated is attached to the negative terminal of a battery termed the cathode, and a bar of silver to the positive terminal, termed the anode, and both are immersed in a bath of a suitable character. When a current is caused to pass through the circuit, part of the silver is removed from the bar at the positive terminal and deposited upon the article to be silvered at the other terminal. Substitute, in imagination, the gas-main for the silver bar at the positive terminal, and the tram rail or earth plate for the negative terminal, and a packet of moist, saline, or sewage impregnated earth for the bath, and the conditions are reproduced with sufficient accuracy for the purpose of illustration. The current leaving the gas-main takes a portion of iron from the body of the pipe, forming ferrous salts. As this operation proceeds, the pitting of the pipe, in consequence of the more or less continuous removal of these small particles of metal, slowly but surely assumes a grave aspect, until, if continued long enough, the wall of the pipe is completely eaten through. The rapidity of the process, of course, depends upon the amount of current and the period of time during which the action is continued. Professor Sylvanus Thompson has estimated that a continuous current of one ampere acting for a year would remove 14 lbs. of metal from the pipe. American observers have placed it as high as 20 lbs. per annum.

For a long time the idea that gas and water mains would suffer by means of stray currents was vigorously pooh-poohed by interested parties. The theoretical possibility was allowed; but it was contended that, as a matter of practice, the damage, if any, would be of such infinitesimal proportions as to be absolutely negligible. Well, extreme cases prove tendencies; and the reckless way in which current has been allowed to stray from the light railways in some American cities, as narrated in the Report of the American Committee on Electrolysis, and the consequential damage to gas and water distributing systems, has proved clearly the potentialities of the situation. In one place actual tests made showed a loss of metal on a single service-pipe of over 1 lb. in a month. In another, differences of potential of 10 volts were commonly found, at one point reaching as high as 35 volts. Well-defined pittings have been discovered on an 8-inch main within six weeks of the pipe being laid new. In five years from the time at which it was laid new, pittings to the depth of 0·45 inch were eaten in a 12-inch pipe; and a length of 200 yards had to be taken up and replaced. These are just a few instances culled at random from the report.

Now it must be admitted at once that we have nothing comparable to this deplorable condition of things in our own country. The Board of Trade insist on infinitely better conditions being maintained here. What the Board of Trade's regulations exactly are, I have not time to describe here; but anyone may obtain a copy of them for a few coppers. The question is whether, with the much smaller quantity of current found flowing in our own mains, there is real risk of serious electrolytic corrosion taking place. It is interesting to note that prominent electricians differ considerably on this point. We have eminent men like Professor Ayrton and Dr. Hopkinson stating quite frankly that dangerous corrosion may take place even when tramways are worked considerably within the limits allowed by the Board of Trade. Others, again, deny that there is the slightest danger so long as the Board of Trade requirements are fully met. But, fortunately, or unfortunately I should perhaps have said, we are in a position to put the matter to actual proof. Some three or four years ago I carried out a very full electrolytic survey over the whole of the city, in the course of which some hundreds of tests were made. In not a single instance were the Board of Trade's regulations being transgressed. Yet I have come across undoubted electrolytic damage, some instances of which are on the table. They are serious, as you see; and yet all have occurred within limits of working which were supposed to secure absolute immunity from damage.

Now what is the practical end to which I have been leading? It is not too much to say that, as far as any direct measures are concerned, we are utterly powerless to protect ourselves. We are quite at the mercy of the electricity user so long as the Board of Trade regulations are observed. But that is no reason why we should adopt a passive attitude and let things work themselves out. May I suggest a few things which should be done in every district served by an electric railway?

First of all, I presume that in all well-appointed distribution departments there are maps showing the sizes and positions of all gas-mains. It will save considerable time and trouble if, in addition to these, we can obtain a plan showing the number and position of the tramway return feeders. Having these to commence with, we should then institute a systematic survey along each tramway route for difference of potential between rails and main; marking in different colours upon the map where the main is negative or positive to the rail—say, red for the latter and blue or other distinctive colour for the former.

These tests are made by means of Weston's volt-meter. The terminals of this instrument are attached to the rail and mains respectively by means of connecting wires. It is obviously of the utmost importance to secure perfect metallic contact at both rail and mains end of the wire. In the case of the rail, this is easy. With the cutting edge of a three square file the metal of the rail is bared and the well-cleaned wire pressed into perfect contact with any tool which may be handy. With respect to the gas-main, the problem is not so simple. Some have suggested attachments to house or lamp service or other such easily get-at-able pipes. For my own part, I utterly distrust the results of tests obtained in such a way. For many reasons it is next to impossible to obtain good contact with the main in this manner. The only way of getting perfect contact is to bare the main, cut a small hole into it, and into the clean thread in the main screw a short piece of stopped pipe having also a clean thread, and to the stopped end of which a connecting wire has been soldered. In this way the contact is made as perfect as possible.

When other large pipes lie in the proximity of the gas-main under examination, tests for differences of potential should always be made between these and the gas-mains. The latter may be negative to the rail but positive to other mains in the vicinity. The importance of this lies in the fact that current received from the rail may be passed on to the other near main and a possible danger zone go undetected. But it is not sufficient to obtain the difference of potential; we want also some indication of the current densities present. These will vary considerably for the same difference of potential, according to the size of the main under test. The difference of potential may be low in a large pipe, while the quantity of current passing may be comparatively high. This test is made by means of a Weston's ammeter graduated in $\frac{1}{10}$ amperes from zero to 15 amperes. For convenience, I keep both my instruments in a partitioned box.

As we proceed with our survey—assuming for the moment that there are no return feeders—we shall find that, starting from the terminus with the highest difference of potential, the main being negative to rail, the difference gradually decreases until a neutral point is reached, where considerable oscillation takes place from negative to positive, according to the distribution of load. From this point, again, the difference of potential becomes greater as we approach the generating station; but the main has now become positive to the rail. From this area the current leaves the main by the line of least resistance for the final stage of its return back to the power-station. On many routes, however, there will be one

or more return feeders provided to suck the current from the rails back again to the generating station. By the consequential reduction of potential, the gas-main becomes positive to the rail, and any current travelling by the main will leave the latter to return to the rail at or near this point. We, therefore, not only have a principal danger zone in the neighbourhood of the power stations, but also a subsidiary danger zone in the area surrounding each return feeder.

If we wish to measure absolutely the quantity of current that happens to be carried by any main, a rather different method must be adopted. This is the test applied to one of our large mains in 1903, and is also fully described by Professor Ganz in his paper read before the American Gas Institute last year. By means of a very delicate milli-voltmeter, the difference of potential between two points on the same main—say, some 100 to 200 feet apart—is taken. The drop of potential divided by the resistance of the pipe in ohms gives the current passing in amperes. The resistances are given in a paper by Mr. Maury on "Surveys for Electrolysis and Their Results," read before the American Water-Works Association in 1903, as 0·00144 ohm per pound-foot for cast-iron, and of 0·000181 ohm per pound-foot for wrought iron. The resistance of pipe per foot is found by dividing the foregoing figures by the weight of pipe per foot. A table of these resistances, worked out, is given in the very able lecture on electrolysis by Professor Ganz previously referred to.

Inasmuch, however, as these resistances are for continuous and homogeneous lengths of pipes, and such a length as I have suggested must contain many joints, allowance has to be made for the resistance offered by these. In the case of a main newly laid, where all the joints are tightly caulked, it would only be necessary to test a single joint, as the resistance in each would be approximately equal. But in an old main, the resistances of the joints vary considerably. A series of tests carried out some years ago at our own works showed that there was a great difference even between joints apparently equally tight. These joint resistances may be many hundred times as great as that of an equal length of plain pipe. It would obviously be a costly and inconvenient business to test all these joints separately; and, consequently it is better to measure the difference of potential between two points upon the same pipe as far apart as possible. This is a much more delicate business, but one which completely eliminates the factor of joint resistance.

By the time our survey has been completed and posted upon the maps, we shall have obtained three items of information without which further progress is impossible. We shall know whether, and to what extent, the tramway is being worked within the Board of Trade regulations; we shall have ascertained the area within which current may leave the mains to return to the generating station; we shall also know the points of greatest danger within the danger zone, and consequently, the area within which most careful watch should be maintained for any evidence of electrolytic damage. Now assume for a moment that this careful scrutiny of the pipes, as from time to time repairs are carried out or pipes are uncovered in the course of other excavations, reveals distinct evidence of electrolytic damage. We shall, of course, be met by our electrical friends with the denial that the damage done is due to the suggested cause, and the assertion that it is owing to the ordinary corrosion which is continually going on quite independently of tramway working. The question then arises: Are there any clear and indubitable signs by which we may differentiate between electrolytic and ordinary corrosion? It is, of course, impossible to label a current; but I think that, both directly and indirectly, we may be able to distinguish between the two.

First of all, directly. What are the signs by which electrolysis of our pipes may be recognised? In order to confirm my own observation of suspected pipes, I carried out a test upon a perfectly sound and good piece of 2-inch steam-tube. It was buried in a box containing dry loamy soil, and the latter saturated with distilled water. A current of 4½ amperes average was passed through the pipe for 288 hours. At the end of that time the pipe was taken out. On turning up my notes made at the time (this test was carried out in 1903), I find the following remarks: Along the pipe there was general pitting, with some shredding of the fibres of the tube. There were two principal pit-marks of an irregular oval shape attaining a maximum depth of ¼ inch. There was the characteristic blue discoloration at first, changing to a brown oxide tint after a short exposure to the air. The shredding was most marked near the end of the pipe, and the pitting was greatest on the side turned to the negative terminal. The direct evidences are therefore: (*a*) A bright bluish discoloration, which rapidly turns brown on exposure to the air. (*b*) Pitting, more or less localized upon an otherwise sound piece of pipe, developing in time to complete perforation of the wall of the pipe. (*c*) In the case of wrought-iron tubes, a considerable amount of shredding may accompany the pitting. (*d*) Whereas in ordinary corrosion the worst portion is usually the underside of the pipe, electrolytic corrosion is frequently worse at the upper side. (*e*) In the case of cast-iron pipes, the iron is so reduced that it may be easily cut with a knife. Frequently the form of the pipe is maintained, and the damage can only be ascertained by very careful examination. In one case, chemical analysis of the pipe showed no less than 22·3 per cent. of graphite and only 49·7 per cent. of iron; whereas a good new pipe should contain 92 per cent. of iron and only 3 per cent. of graphitic carbon.

These direct evidences may be very materially supported by others of an indirect character. At a suitable number of points within the area of greatest danger, sheet-lead plates of 9 or 10 inches square should be buried in pairs. One of the two should be attached by wire and soldered joints to a lamp or house service. The second plate should be simply buried in the earth, some 12 or 15 inches distant from the first. In the event of any stray current tending to leave the pipes near one of these points, the wire connection and lead plate form an excellent path to earth. And inasmuch as the same amount of current corrodes lead much more rapidly than iron, in about the proportion of 7 to 2, the effects of electrolysis upon the lead plate will be comparatively well defined. The second plate is buried in the earth to ascertain the degree of corrosion due to the unaided action of the earth and any salts that may be present. If then periodical examination reveals traces of increasing corrosion on the connected plate of which there are no traces upon the loose one, it is evident that the corrosion cannot be due to the natural action of the earth, or both would be equally affected. It can only be due to current escaping, since that is the only factor present in one which is absent in the other. Should both be similarly attacked, then it follows that the corrosion is not due to current, for the same reason.

To sum up, if we have at any point a difference of potential in which mains and services are positive to the tram rails, which is accompanied by corrosion that conforms to the peculiarities noted above, and the whole of which is supported by the testimony of the lead plates, we shall have a body of evidence which no amount of partisanship can set aside. The special point to which our efforts should be directed is to bring pressure to bear upon the tramway undertakings to keep their rails below earth potential. This may be done by the provision of a sufficient number of return feeders and negative boosters. This is, however, not obligatory, or anything like it, under the Board of Trade regulations which really govern the situation. These prescribe the maximum beyond which the undertaking may not go; but no mention is made of any minimum. Now as many, if not most, electric tramway undertakings belong to the local authorities, it is possible, with clearly proved instances of damage in our hands, to bring such pressure to bear in the direction I have indicated as they would be unable to withstand. Any modifications introduced on the lines owned by local authorities would be made compulsory for any possible intractable private company.

In the detail work of collecting evidence which will enable a sufficient pressure to be exercised, the members of this and similar societies may take a very valuable and important part.

The loud applause which greeted the lecturer on the conclusion of his address was no mere formal following of a custom, but an indication and a measure of the keen interest and concentrated attention with which it had been followed. Now and again Mr. Hole left his manuscript to explain his models, to exhibit his "ghastly specimens" of electrolytically damaged pipes, to elucidate his meaning with black-board sketches, and to supplement his written copy with fuller details of the incidents and experiences there mentioned. All this not only added to the value but to the interest of the address—especially as the lecturer's voice and delivery left nothing to be desired.

In throwing the meeting open for questions, which Mr. Hole had kindly promised to deal with, the President expressed his sense of the extreme value of the memorable address just given. He could not help a wistful longing, as he heard that whatever amount of electricity was developed at a power station an equal amount returned to it in spite of all leakages, that all their escaping gas would return of its own accord to the gas-works. Their electrical friends, however, could sympathize with them, inasmuch as their leaking electricity did not make the records of meters advance any more than leaking gas did. He had been much interested in the descriptions of various joints, and would be glad to hear Mr. Hole's views on the comparative values of lead wool and cast lead. From his own experience, he preferred the former.

In reply to questions from Mr. Booth with reference to the test carried out on a buried piece of pipe, Mr. Hole explained that the test was undertaken jointly with the electrical authorities; that the terminals were buried from 18 to 24 inches apart in a box 3 feet square; and while the current was of 4½ amperes average, it varied from 2 to 8 amperes during the test of 288 hours. Replying to Mr. Butterfield, he had no doubt that lead wool would give stronger joints than cast-lead rings; and he had recently jointed a 20-inch main with it, and maintained a pressure of 35 lbs. for 14 hours without any leakage.

Mr. Hill inquired if any less leakage would be likely from electrical tramways worked on the surface-contact system. Mr. Hole stated that he did not know. But in this case, too, much depended on the supply of sufficient return feeders to keep the rails below the earth potential; otherwise leakage would ensue. He explained that, though as much electricity must always return to the power station as was sent out, still unaccounted-for electricity was as real a trouble as unaccounted-for gas; and, as somebody had interjected, it neither worked meters nor cars.

Replying to Mr. Cranfield, who asked as to the length of time the bright blue discoloration lasted which was a direct evidence of electrolysis, Mr. Hole stated that it never lasted beyond thirty minutes, and had sometimes quite disappeared in ten minutes. In all cases it was gradually changing from the moment it was first exposed to the air.

Mr. Fell proposed a vote of thanks to the lecturer. He bore

testimony to the value of the information given, and expressed pleasure at the lucid way in which it had been presented. His own branch of work had afforded him many examples of the kinds of damage, electrical and mechanical, that had been referred to; and he had often shuddered at the sight of a heavy traction engine (frequently going at too high a speed), and the thought of the damage it might cause, which might escape detection for some time, and be found out only when no proof could be adduced as to the immediate cause. If not so pitiably unjust, it would be amusing to note how, as every one of the damages due to excessive vibration or electrical vagaries would result in the escape of gas, all the blame both for the escape and its possible results would be laid upon gas. He should be glad to hear Mr. Hole's views on the proper depth at which to lay gas-mains.

Mr. Fligg seconded the vote of thanks, and referred to the general interest in Mr. Hole's articles and recent book.

Mr. Hole, in replying, and acknowledging the marked cordiality and heartiness with which the vote had been passed, referred to the question of the depth and position of gas-mains. He looked forward with interest to a more general use of what was nearest to the ideal arrangement—viz., special subways. The next best plan was to put mains under footpaths wherever possible, as by this means many of the risks arising from excessive vibration were avoided. When mains had to be laid under roads, an average of 2 ft. 6 in. between the top of the main and the road surface should be aimed at. But even this would vary greatly under different conditions, because, on the one hand, water-mains, electric cables, drains, &c., might prevent the realization of one's desires, and, on the other hand, trunk mains and high-pressure mains, which would not often want to be opened out, might with the greatest advantage be put lower than 2 ft. 6 in. below the surface, and decidedly should be so put. He had often wanted to meet the members of the Junior Association, and had been glad of the opportunity of doing so that afternoon.

After the close of the meeting, the members lingered long inspecting and discussing the various diagrams and specimens; and Mr. Hole and his assistants were kept busy answering the questions showered upon them. No little interest was exhibited in a district plan of the Leeds electricity distribution system, showing the return feeders which operate so powerfully in reducing the risks of electrolytic damage to gas-mains, and which were largely installed as the result of Mr. Hole's vigorous and persistent agitation for them.

PERSONAL.

Mr. JOHN IRELAND, jun., of Tayport, has been appointed Manager of the Auchterarder Gas Company, in succession to the late Mr. A. Lobban. Last Friday evening, Mr. Ireland was met by a few friends in Tayport, and presented with a timepiece as a token of good-will.

Last week we announced, in a few lines, the appointment of Mr. C. B. NEWTON, M.Inst.C.E., F.C.S., to the position of Water and Gas Engineer to the Hull Corporation. Mr. Newton commenced his career with the Shrewsbury Gaslight Company, and received his training under Mr. William Belton, whom he served for many years as Assistant. From Shrewsbury, Mr. Newton removed to Sheffield, to take up the position of Superintendent of the Effingham Street Gas-Works. He held this post for twelve months, and resigned early in 1892 on his election as Gas and Water Engineer to the Corporation of Rotherham. At Rotherham, he designed and carried out large extensions of the gas-works, and was also the Parliamentary Engineer for a Bill for the construction of new gas and water works. In 1895, Mr. Newton was appointed Gas and Water Engineer to the Corporation of Carlisle. He originated and designed a new scheme with impounding reservoir for a supply of water by gravitation to the city, and was subsequently instrumental in securing parliamentary sanction for the work. The question of the future water supply for the city had been under consideration for many years, off and on; and numerous schemes had been propounded and discussed from time to time. But it eventually fell to Mr. Newton's lot to initiate the scheme which has recently been brought to a successful issue. For the past six years, Mr. Newton has been in private practice as a Consulting Engineer in Carlisle. The City of Hull has a population of 270,000; and its water supply is derived from wells in the chalk. There were no less than 127 candidates for the appointment.

Coke and Bye-Products in the United States.—According to a paper just published by Mr. E. W. Parker, the Chief Statistician of the United States Geological Survey, as an advance chapter from "The Mineral Resources of the United States in the Year 1907," 40,779,564 short tons of coke were produced in the year named, of which 5,607,899 short tons, valued at $21,667,157, were made in retort-ovens, and bye-products of the value of $7,548,071 recovered. These bye-products consisted of 20,516¼ million cubic feet of gas, valued at $3,130,835; 53,995,795 gallons of tar, at $1,242,534; and 125,372,360 lbs. of ammonia (sulphate or reduced to its equivalent), at $3,174,702. The gas is the "surplus" not consumed in the coking process, and is either sold or used at the manufacturing establishments operated in connection with the coke-oven plant.

REMOVING SULPHUR COMPOUNDS FROM OIL GAS.

The gas supplied by the Portland (Ore.) Gas Company is manufactured by the so-called "crude oil water gas" process, which is generally used by the gas companies on the Pacific coast. As most of the crude oil coming from California contains quantities of sulphur, the amount of this impurity in the produced gas was found to be high; and discomfort to the consumers was the result. With the view of removing this trouble, the Company's Manager (Mr. E. L. Hall) undertook a series of experiments which extended over two years. For the removal of the organic sulphur, the old "sulphided lime" method was first resorted to, but was abandoned on account of the high cost and uncertainty attending its use. Following this, attempts were made to vary the operating and purifying conditions; but they were attended by meagre results. The last and most promising of all the methods tried was the passing of the gas through red-hot tubes in order to break-down the organic sulphur to sulphuretted hydrogen, which could be easily removed by the oxide of iron purifiers. Mr. Hall gave an account of his experiments in a paper prepared for the meeting of the Pacific Coast Gas Association at Santa Cruz (Cal.).

The first experiment was performed in a piece of hard glass tubing heated in a combustion furnace. Purified gas was passed through, and gave a stain on lead acetate paper. The glass was replaced by a piece of iron pipe as the heats raised, and with even better results. The introduction of steam still further increased the efficiency. The process was set up on a small scale in the laboratory and was run for some time. The analysis of the reheated and purified gas showed that 66 per cent. of the organic sulphur was removed.

After this, a small plant was erected, consisting at first of a 30-inch cast-iron pipe filled with scrap iron heated in a brick oven and connected to two 6 feet square purifiers. The gas was taken from the outlet of the station meter, and discharged into the storage holder. Owing to the large size of the pipe, the best result that could be obtained steadily was 50 per cent. removed at the rate of 15,000 cubic feet per hour. This arrangement was replaced by five 4-inch and eight 3-inch tubes, 8 ft. 6 in. long, with a total heating surface of 126½ square feet. The results obtained with these tubes were much improved. Various rates of flow and amounts of steam were tried as tabulated below:—

Flow of Gas. Cubic Feet per Hour.	Steam, ½-inch Nozzle.	Temperature in Degrees Cent.	Temperature in Degrees Fahr.	Grains H_2S per 100 Cub. Ft. by Titration with Iodine.
19,700	None	350	662	15
17,000	Half open	460	860	15
15,000	Full	500	932	25
14,200	Half open	410	770	50
10,200	,,	520	968	50
Aver. 15,280	..	448	838	31

These results could undoubtedly have been improved with still smaller tubes, giving better contact; also by retainers in the tubes to disseminate the heat and impart a mixing motion to the gas. But the heat destroyed the iron pipes too rapidly, and they were abandoned in favour of an internally-heated apparatus. It consists of two fire-brick-lined shells, filled with staggered checker brick like the ordinary water-gas superheater. Between these two is another shell similarly lined and filled, but about half as high. This shell or generator is equipped with either oil-burners or solid fuel, for alternately heating up the two gas reheaters. For this purpose the generator is connected up on either side by hot valves with the bottom of the reheaters. The latter are provided with the regulation stack-valves and off-takes dipping into a common wash-box. The purified gas is admitted alternately to the bottom of each reheater, and flows through the hot brick, where the organic sulphur is broken down into sulphuretted hydrogen. After going through the wash-box, the gas is passed through a scrubber, and then through secondary oxide of iron purifiers.

In this process the bricks are maintained at a cherry red heat; and at this temperature (700° to 900° C.) the organic sulphur is almost completely broken down; and remaining after a second purification there will be only traces of organic sulphur. At this temperature the illuminating power does not seem to suffer at all. However, in oil-gas making this is a matter of indifference; for lower heats can easily be carried in the gas-generators, making the gas just rich enough to offset any loss in the reheaters, and, of course, at the same expenditure of oil per 1000 cubic feet in either case. It has not been found necessary to introduce steam into the reheaters, as aqueous vapour is normally present in the gas in sufficient volume to furnish nascent hydrogen for the reaction. The plant has been operating steadily, and the organic sulphur is broken down with great certainty.

In conclusion, the following theory is offered to cover the facts as set forth in this paper. The formation of carbon bisulphide in the generator may be conceived as being due to a reaction between the sulphuretted hydrogen and the carbon produced by decomposition of the oil, according to the equation—

$$2H_2S + C = CS_2 + 2H_2.$$

When one considers that sulphur and oxygen are of the same

chemical family, and act analogously in many ways, we see at once the counterpart of the well-known water-gas reaction—

$$2H_2O + C = CO_2 + 2H_2,$$

which strengthens the theory. The fact that the water-gas reaction increases in efficiency with the rise of temperature argues for the same effect in the analogous bisulphide of carbon reaction. In other words, we would expect that a larger proportion of the total sulphur would appear as bisulphide of carbon with higher heats; and this has been the universal experience of gas men. In the vertical retorts, as at Dessau, where the gas is not exposed to overheating as in the horizontal retorts, lower bisulphide of carbon has been found. For any one temperature effect, therefore, a certain definite ratio of sulphuretted hydrogen to bisulphide of carbon may be expected. In oil-gas conditions and temperatures it may be taken as somewhere about 8·5 : 1. It is to be expected that a point may be reached in temperature where the ratio will no longer increase, and may, in fact, decrease. In the reheating effect, we have merely the necessary readjustment to this same ratio after the removal of one side of the equation and the restoration of the temperature of reaction.

THE STEAMLESS RADIATOR.

When noticing the novelties introduced for the forthcoming gas-heating season by the Davis Gas-Stove Company, Limited, in the "Journal" for the 29th ult. (p. 850), some reference was made to the new steamless radiator which the firm are putting upon the market, and an illustration of the apparatus was given. In view, however, of the interest that is being taken in this departure from radiator practice, some fuller description than was at the time possible seems called for; and this being so, a visit was paid last week to the Company's Queen Victoria Street show-rooms, in order that readers might be made better acquainted with the features and claims of the appliance.

It may be remarked that the "first impression" given by the radiator is that it is an excellently turned out article, and of strikingly simple appearance. It can, of course, be had in various colours; but those on view in the show-rooms are finished in the firm's special new art black, which gives them an exceedingly handsome appearance, and enables one to fully appreciate the glass-like smoothness of the "loops." As to the simplicity, it is noticeable that there is an entire absence of anything that could be likely to require periodical attention or give trouble. No complicated parts of any kind are to be seen; and this idea of simplicity is emphasized on closer investigation.

The claim, however, upon which the Company really take their stand is the even distribution of heat over the whole surface secured by this form of apparatus without the aid of steam; and that there is this even distribution they demonstrate by showing the radiator in action. This result they obtain by means of a specially arranged internal steel tube, into which the gas-flame enters without contact with any substance whatever—which, of course, does away with any question of smell that might otherwise arise through interference with the proper combustion of the gas. Each loop has its tube; and each tube has its own burner-nozzle. Another point is the gas consumption. With a steam radiator, the columns are of necessity somewhat heavy in make; and, in addition to this, when first lighting up there is the water to be heated before the apparatus really comes into action. There being no question of steam in connection with the Davis radiator, a slighter form of loop is rendered practicable; and there being no water to heat, a regular consumption of gas can be maintained from the moment of lighting up. As the burner for a 39-inch radiator is regulated to give a consumption of 2 cubic feet for each nozzle, this, for a four-loop one, gives a maximum gas requirement of 8 cubic feet per hour; whereas with a steam radiator there must be a larger consumption until the apparatus is thoroughly heated up, when, of course, a reduction automatically takes place. In short, the Davis Company claim that their own maximum consumption is the minimum consumption of the steam radiator. Again, should the steamless radiator be required on a mild day when little warmth is needed, the burners can be turned down to any desired extent so as to lessen the heat given off, thus reducing the 8 cubic feet per hour gas consumption referred to. In other words, the steamless radiator can be controlled at will; while with a steam radiator there must be sufficient gas burnt to secure the steam effect.

The factor of simplicity may now be briefly touched upon, as in importance it is certainly, both from the gas supplier's and the user's point of view, worthy to rank side by side with efficiency and economy. Here are the full instructions for use: "Pull down the lighting door; turn on the gas; light it; close the door again. Turn out the gas when done with." The simple act of lighting is rendered still easier than would otherwise be the case by the fact that, by a convenient arrangement, the opening of the door turns the burner round until the nozzles are in the most suitable position for lighting, while the act of shutting replaces it in its proper position. Then, of course, there is no need to pour in water at intervals. This is simplicity as it appeals to the user. The aspect of the question which appeals to the gas authority or other persons who might be called upon to take the apparatus to pieces and put it together again is the extreme ease and quickness with which this operation can be accomplished—about ten minutes being the time occupied in the case of a four-loop radiator. In order to take it to pieces, all that is necessary is to undo one nut at the top, and two screws at the bottom.

The radiators can be had in four widths—two, four, six, and eight columns; and they are made in two heights—32 inches and 39 inches. It is said that a room measuring 20 feet by 14 feet may be effectively heated by a four-loop 39-inch radiator. The burner is fitted with a patent governor and gas and air adjuster; and it is reversible, so that the gas connection can be made on either side. The apparatus, it is pointed out, is not a hot-air radiator, because it is merely the heating of the loops that gives out the warmth. In conclusion, it may be remarked that the Davis Company (who have spent much time upon the perfecting of this welcome addition to the existing types of gas-heating appliances) regard the future of the radiator with an optimism which the great interest that is already being taken in it certainly does something to justify. Although only about a month has elapsed since the members of the Eastern Counties' Gas Managers' Association were introduced to the steamless radiator at Luton, the firm have had orders for samples from over a hundred gas companies, while inquiries have been received from places situated so far apart as Germany and Greece.

RAISING AND SUPPORTING A GASHOLDER.

The large holder of the Portland (Ore.) Gas Company, having a capacity of 1½ million cubic feet, was erected in 1905, and completed ready for use early the following year. It has a diameter of 140 feet, and, when filled, rises to a height equal to its diameter. The tank is 143 ft. 6 in. in diameter and 35 feet deep. The foundation consists of piles driven as close together as they could be placed, having on top of them a layer of concrete. The ground upon which the holder stands is above a slough of uncertain depth; and as the driving of piles progressed, those first put in were probably forced upwards, and when the tank was filled the foundation settled so unevenly as to render the holder useless. The tank was then emptied and examined, and it was discovered that there had been settlement at various points ranging from ¾ inch to 9 inches; the greatest being near the centre. The difference between the least and the greatest settlement shown at the shell was 3½ inches, of which there was comparatively little in one-half of the circumference. After due consideration of the conditions, it was assumed that, as the foundation had sustained the weight of water for a week, whatever settlement there might be in the future would be slight and even. It was therefore decided to put the holder back into its original shape, fill the tank again, and watch results. The operations which took place consequent upon this decision are described in an article by Mr. W. R. Phillips in "Engineering Record," from which the following particulars have been obtained.

In order that the process of raising might be better understood, the author gave a description of the parts of the holder involved. The shell of the tank is built of plates of varying thickness up to 1 inch, according to the depth; the floor being of ¼-inch plates, which rested originally on a cushion of a mixture of sand and cement laid dry. The guide-columns, of which there are 15, supported from the wall of the tank, are of I section, with lattice girders between them. Inside the tank is the usual timber framework upon which the crown of the inner lift rests when it is down; the other two lifts being supported upon thirty rest-blocks.

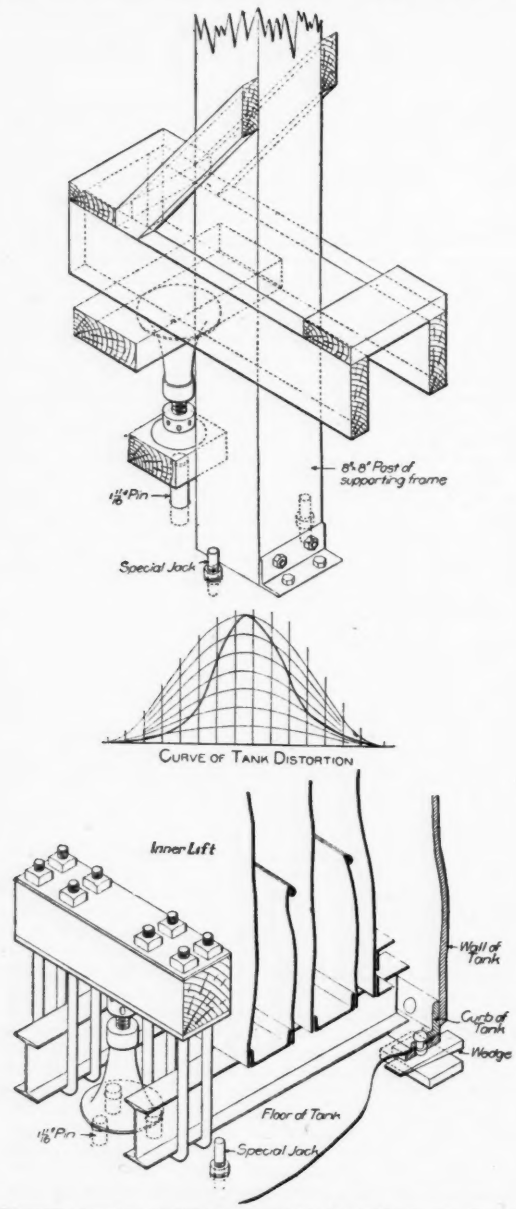
The work of raising had to be done in four stages. First, the floor of the tank and the crown of the inner lift had to be lifted; then the shells of the three lifts; afterwards the wall of the tank, with the guide-columns; and, finally, the rounding-up of the crown and the levelling of the rest-blocks. All the work done towards raising the holder and the floor of the tank had to be carried on inside the tank. This necessitated supporting the raising mechanism from the foundation through openings in the floor. They consisted of drilled holes tapped for 1½-inch pipe; and they were placed at each post of the supporting frame, including the king-post, and at each vertical leg and rest-block. Jacks were used for the purpose of raising the lifts. At all the posts of the timber framework there were inverted jack-screws; the bottom of each jack acting against a bracket secured to the post, and the top against a block of hard wood recessed to receive the upper end of the pin upon which it rested. The other end of the pin pressed against the concrete of the foundation.

The raising of the three lifts had to be done at one operation; and, as there was a space of only 8 inches, or the height of the rest-blocks, under their lower edges, a lever was used at each vertical leg. It was composed of two 6-inch I-beams placed side by side, one end resting on the angle forming the curb, and the other hanging from a yoke, under which there was a lifting-jack carried upon three pins resting upon the foundation and forming a tripod base. At each post, alongside each jack used to raise the lifts, and at the inner end of each rest-block, was also a jack-screw of special construction for raising the floor. It consisted of a cast-iron nut tapped with a 1-inch machine thread, and threaded on the outside for 1½-inch pipe. The nuts were screwed into holes in the floor-plates, and 1-inch steel threaded screws passed through them, bearing against the foundation.

The floor of the tank and the crown of the inner lift had to be raised at the same time, for the reason that the posts of the frame supporting the crown were attached to the floor, and it was desir-

able that the bolts securing them should not be broken. Consequently, simultaneously with the raising of each post the floor-plates were raised by means of the special jacks placed alongside. Neither during this operation nor at any other time was attention paid to the level of the floor; the aim being the smoothing out of the crown. When it was done to such an extent that the raising of the other parts would not unduly buckle the plates of the crown, the three lifts were raised. Then whatever buckles were formed in the crown by this operation were taken out by means of the jacks under the supporting framework, as in the first raising. All lifting on the jacks was done piecemeal, so to speak—not more than three or four jacks being worked at once. The crew were continually shifted to new positions; the part showing the greatest distortion being attended to first.

At the beginning of the work, in order to find the exact amount that the tank was out of level, measurements above a horizontal plane had been taken at fifteen points on the circumference. These measurements were plotted as vertical ordinates at equal distances apart, resulting in the heavy curve shown in the accompanying diagram. The levelling was started at the part of the



Diagrams showing the Appliances used in Straightening the Tank.

tank represented by the highest part of the curve, where the measurement amounted to slightly over 3½ inches. Had the bottom of the tank been flat, and merely inclined to the horizontal, the highest smooth curve would have represented those values. The other smooth curves were similarly drawn, but for successively lower values of the maximum, and approached at a horizontal line which represented the object aimed at—a true horizontal plane.

The shell of the tank was raised by means of steel wedges. For starting them, channels extending under the edge of the shell were cut into the concrete. For each wedge there was a steel casting to keep it free from the rivet-heads; also steel blocking to follow up with. As it was desirable that whatever strain the shell might be under should be relieved rather than aggravated by the wedging, it was begun at the point of greatest distortion shown by the curve, and carried gradually in each direction as the irregularities were taken out, half-an-inch at a time.

In driving the wedges, as in lifting with the jacks, only small crews were worked, and they were constantly being shifted to new sets of wedges. Coincident with the driving of the wedges, a man inside the holder followed the crews and adjusted the jacks which supported the inner ends of the levers upon which the shells of the sections rested. The reason for this precaution was that, as the outer ends of the 6-inch beams which were part of these levers rested upon the curb of the tank, the wedging-up would raise the shells of the lifts and tend to throw the jacks out of position—allowing the lifts to drop, and causing serious damage to the holder.

After the completion of the wedging, the rest-blocks were levelled to a line with the outer edge of the tank by means of the special jacks, placed as already mentioned. Where there was room enough, concrete was rammed under the floor to support the rest-blocks from the foundation. When this was impossible, a thin grouting was forced under. The lifts were now lowered on to the rest-blocks, the weight of each post put upon its special jack, and all screw-jacks removed, except the four round the king-post. There was now a space under the floor varying from nothing to 9 inches, and a new cushion had to be inserted that would entirely fill it. In selecting the proper material for this cushion, grouting, wet sand, and dry sand were all considered; but, on account of cost and the probable difficulty of manipulation, grouting had to give way to sand. As the use of this material dry presented difficulties, fine wet sand was selected.

To convey the sand underneath the floor, 2-inch wrought-iron piping was used; this being the largest size that could be made to pass the rivet-heads under the tank. In all, the pipe was placed in seven different positions before the space was entirely filled; the spots being selected so as to accomplish the filling progressively, in order that no voids might be left. Pipes ranging from 40 to 110 feet were used. The injector for feeding the sand into the pipe was made up of pipe fittings; a 6-inch T-piece forming the body being bushed at the ends of the run for the pipe and for the nozzle supplying the water. The branch of the T formed the hopper for feeding; the sand being taken up by the jet and forced through the pipe. Skill was required on the part of the feeder in breaking the jet so that it would carry the sand—a smooth jet simply boring its way through. The water used was obtained from the pumping plant on the works, under a head of 50 lbs. per square inch; and a ½-inch nozzle was used for the jet.

The sand was brought to the feeder in barrows and fed into the hopper by shovelfuls. When the pipe was started in a new position, the sand would be taken up as fast as it could be shovelled. But as the space covered by the pipe began to fill, the feeding had to be slower, and great care exercised to prevent the pipe being choked off too soon. The progress of sanding was watched from inside the tank through the holes used for the jack-screws. When the bottom of the tank had been raised, the sag between the screws was considerable in places, and some uncertainty was felt as to whether it would fill at these spaces; but when the sand was injected, it not only filled them, but raised them above the level of the bases of the posts—in some places, to the extent of 4 inches or more. The loosening of the jack-bolts showed that the posts were also raised, and the king-post was put up 1½ inches.

The flow of the injected sand and water was somewhat unaccountable at times. The breaking out of the flow at the edges of the tank had to be watched, and was controlled by raising a dam of sand round the break, and conducting the excess of water through the dam by means of short pieces of pipe. It was estimated that 160 cubic yards of sand would fill the space; but 425 cubic yards were used. There were two reasons for this difference; in the first place, the shrinkage of the sand itself, amounting to about 20 per cent., and secondly the bulging of the floor-plates as already mentioned.

All that remained to be done before water could be put into the tank was to remove the remaining jack-screws, stop all holes with 1½-inch pipe plugs, and put a concrete kerb round the outer edge to retain the sand. All pipe connections were caulked afresh. The three stand-pipes, two of which were raised with the tank, were tested by being filled with water; and when such breaks as had developed in them had been attended to, the tank was considered ready for filling. That the process might be watched, a boat had been built inside the tank. The first operation was to cover the bottom with water and nail cleats to posts a measured distance above the surface. By measuring back to these as the filling progressed, it was possible to watch the effect of the load on the foundation. It was found, as the tank filled, that the posts towards the centre settled, with reference to the other posts, about 1½ inches; but when the water had been left standing a few days after the tank was sufficiently near being full to render navigation difficult, no change took place. Outside the tank, levels were taken from day to day as the filling progressed, as well as afterwards, and the observations plotted. The curve indicated a gradual slowing-up of the settling; and as it was considered safe to do so, the tank was put into commission. As it is still in use after two years have elapsed, it is to be presumed that the desired result has been accomplished, and that the renewed foundation was true and unyielding.

HIGH-PRESSURE GAS SUPPLY IN LOS ANGELES.

By C. A. Luckenbach.

[Extracts from a Paper presented to the Pacific Coast Gas Association.]

In 1901, the Los Angeles Lighting Company, the predecessors of the Los Angeles Gas and Electric Company, commenced the installation of a high-pressure system, which it was intended should be used both for feeding the then existing low-pressure one and also as a direct high-pressure distributing system. At that time the phenomenal growth of Los Angeles had but fairly commenced, and it was hardly dreamed that in a few years the inhabited territory would almost double, and the outlying districts build up to such an extent as to demand the large additions which have since become necessary. Two high-pressure lines were then installed, each with its own compressor, located at different points in the city. One was for the double purpose of acting as a feeder for the low-pressure system, as well as for direct distribution, and was supplied through a duplex single-stage belt-driven compressor having a piston displacement of 50,000 cubic feet per hour, and capable of working against a pressure of 60 lbs. The other was for feeding the pressure in the East Los Angeles district only, and was supplied through a straight-line belt-driven compressor, having a piston displacement of 19,260 cubic feet per hour, and capable of working against a similar pressure to the other.

The unprecedented increase in building and the rapid extension of the residential territory demanded material extensions; and in 1903—less than a year-and-a-half after the first installation—it was decided to erect a compressor station, put in larger apparatus, and deal with all the compressed gas from one point. This was completed and put in operation in the autumn of 1903. At that time the system consisted of 21⅓ miles of pipe, of which 12 miles was 6-inch main line, and 15⅓ miles of 2-inch laterals, all inside the city of Los Angeles.

Up to that time the primary object in view was the using of the compressed gas for feeding the low-pressure system; and at that date the direct high-pressure distributing system may really be said to have commenced. Twelve miles of 2-inch mains, which had before been on low pressure, were made high-pressure lines; extensions were rapidly carried out beyond the city, and the system extended to South Pasadena, Alhambra, and Dolgeville; and a 6-inch service extension of 4800 feet, for the purpose of furnishing gas to the Pasadena Consolidated Gas Company, was run. In 1905, the construction of a third line, for serving the north-west portion of the city, East Hollywood, and Hollywood City, was completed; and in 1907 the feeder lines of East Los Angeles were connected with the high-pressure system—the four lines comprising on Aug. 1 last 128 miles of feeders and laterals under high pressure.

The compressor station is located approximately 1000 feet from the generating plant of the Company, and within a few feet of two one million cubic feet storage holders. The boiler-room is a brick, steel, and galvanized iron fire-proof building, 42 ft. by 38 ft. and 32 feet high, so arranged that housing for an additional boiler can be provided without interfering with the present structure. The main compressor room is a brick, steel, and galvanized iron fire-proof building, 28 ft. 6 in. wide, 82 feet long, and 19 feet high, so constructed that a duplicate of the present large compressor may be installed and the proper housing provided without interfering with or requiring any change in the present structure. The building for the auxiliary compressors is 50 ft. by 125 ft. and 19 feet high, built of frame and galvanized iron. The two compressor buildings are connected by a covered steel and galvanized iron passage, providing ready communication, and allowing the operators in either building full and unobstructed view of the interior of the other.

Steam is furnished from two 500-H.P. water-tube boilers, each having 2020 square feet of heating surface and 98·85 square feet of grate surface, and built for a working pressure of 150 lbs. Each boiler has its own stack, 60 inches diameter and 100 feet high above the floor level. The boilers are equipped for burning either oil or carbon, and are installed with the idea of adding an additional boiler when the service requires it.

Four compressors have been installed, having a total capacity of 908,000 cubic feet per hour, all built for operating against a pressure of 60 lbs. There are four machines. The most important is a 24 in. and 42 in. by 34 in. by 60 in. Corliss cross-compound duplex compressor, with Cincinnati valve gear on the compressor end, having four inlet-valves on each compressor cylinder and spherical seated bearings on the crank-shaft. The steam and gas cylinders are arranged tandem; the former being next to the frame. The machine is provided with an automatic governor, controlling the speed and pressure by its action upon the cut-off. The frame is of the heavy rolling-mill type; the main pillow-block being cast as part of the bed. The slides are of the bored type, and heavily ribbed. The fly-wheel is 18 feet diameter; and the total weight of the machine is 300,000 lbs. The diameters of the openings are as follows: Steam-pipe, 8 inches; exhaust-pipe, 14 inches; gas suction, 16 inches; gas discharge, 14 inches. The capacity is 553,000 cubic feet per hour.

The other machines are as follows: One belt-driven horizontal duplex compressor, having 25-inch by 24-inch cylinders. This machine weighs 48,000 lbs., and has a capacity of 150,000 cubic feet per hour. Its motive power is a 350-H.P. 500-volt compound-wound direct-current motor. One belt-driven horizontal duplex compressor, having 22-inch by 30-inch cylinders. The machine weighs 46,700 lbs., and has a capacity of 148,000 cubic feet per hour. Its motive power is a 350-H P. 500-volt compound-wound direct-current motor. There is one belt-driven horizontal duplex compressor, having 16-inch by 18-inch cylinders. The machine weighs 13,600 lbs., and has a capacity of 57,000 cubic feet per hour. Its motive power is a 125-H.P. tandem compound engine. The last three machines are provided with suction-valves of the Corliss type and discharge-valves of the regular poppet type—all automatic in action.

Suction is obtained through two 16-inch steel riveted pipes, from two three-lift gasholders, 125 ft. 6 in. in diameter and 123 feet high, each containing when full 1,016,820 cubic feet of gas, and having a pressure of 11 inches on the third lift. These suctions are so arranged that gas may be taken from either or both of the holders at the same time, and so that the main and auxiliary plants may draw from either holder independently at the same time. On the discharge, between the compressors and the distributing board, a compression tank, 5 feet diameter and 11 ft. 3 in. in length, is located for dealing with any sudden fall in pressure. The discharge from all the compressors leads to a common point or distributing board at the inlet of the feeder mains, where, by means of valves, the requisite quantity of gas needed to maintain the necessary pressure in the respective lines is released. The auxiliary compressors are also connected, so that any one of them can discharge into one of the feeder lines while the others are discharging into the main header.

With the exception of a comparatively small portion, all the mains and laterals of the system are genuine wrought-iron screw pipe. For a distance of approximately a mile from the compressor station, lead expansion joints are placed at approximately every 500 feet, and similar ones at each end of all bridges and trestles carrying pipe. At the offtake of each lateral, a gate-valve or stopcock is placed, as well as at each end of all bridges and trestles crossed by the mains. Wherever a service is taken off, a pipe-clamp with lead gasket is used; and stopcocks are placed in the service just after leaving the main and before reaching the meter. Each service has its own regulator set for 4 inches outlet pressure; and all meters are of iron. All pipe is painted with water-gas tar, applied to the steam-heated pipe with a brush.

Four separate and distinct feeders convey gas to the respective districts and to the feeders of the low-pressure districts. Line No. 1 goes to high-pressure district No. 1 and the low-pressure feeders of the south-western portion of the city. This district is 3·2 miles long and 1·8 miles wide, with an approximate area of 5¾ square miles, and the nearest point is 2½ miles from the compressor station. The main feeder line, which is rather more than 5 miles long, is made up of 12-inch, 10-inch, and 6-inch pipe. At the end of the 12-inch section, a connection is made with the 30-inch inlet of the main storage holder of the Company, which is filled from this line. This holder is one of five lifts, 195 feet diameter and 226 feet high, with steel tank, and has a capacity of 5,016,000 cubic feet. The pressure when on the fifth lift is 13·4 inches. At the end of the 10-inch section, or approximately 2 miles from the compressor station, a 6-inch feeder line for the low-pressure system is taken off. This line runs westerly and southerly a distance of 4½ miles, where it connects with another similar feeder line. Additional lines are taken off at several places; the extreme point of the longest feeder being 8 miles from the compressor station. At seven different points along the feeder lines district governors are located, set for pressures varying from 8 to 15 inches. The total lines supplied by line No. 1 are 43 miles 895 feet in length; being 34 miles 895 feet within district No. 1, and 9 miles being feeders for low-pressure mains. There are 3500 meters, and the output will closely approximate 9 million cubic feet per month.

Line No. 2 goes to high-pressure district No. 2, which comprises the north-eastern portion of the city of Los Angeles, and also South Pasadena, Alhambra, and Dolgeville, covering a territory, irregular in shape, with an approximate area of 8½ square miles; the nearest point being some 3 miles from the compressor station. The main feeder is 11 miles 1720 feet long, and is made up of 10-inch, 6-inch, and 4-inch pipe. At three different points, 4-inch and 6-inch laterals are taken off from the main line; one of these being approximately 2 miles long. Through it, gas is supplied to the Pasadena Consolidated Gas Company. The total pipe-lines in this district measure 54 miles 1141 feet. There are 3600 meters; and the output will closely approximate 9¾ million cubic feet per month.

Line No. 3 goes to high-pressure district No. 3, comprising the north-western portion of the city of Los Angeles, East Hollywood, and Hollywood, covering a territory with an approximate area of 3 square miles; the nearest point supplied being 1 mile 3820 feet from the compressor station. The main feeder line is 8 miles 1845 feet long, and is made up of 8-inch and 6-inch pipe. The total pipe-lines in this district measure 26 miles 1165 feet. There are 850 meters, and the output will closely approximate 3·1 million cubic feet per month.

Line No. 4 serves the low-pressure distributing mains of the East Los Angeles district. A single line leads from the compressor station a distance of 4600 feet, when it divides into two mains—one 8700 feet long, the other extending 5800 feet from the dividing-point. The total line under high pressure is 3 miles 3260 feet, and is made up of 8-inch, 6-inch, and 4-inch pipes. At

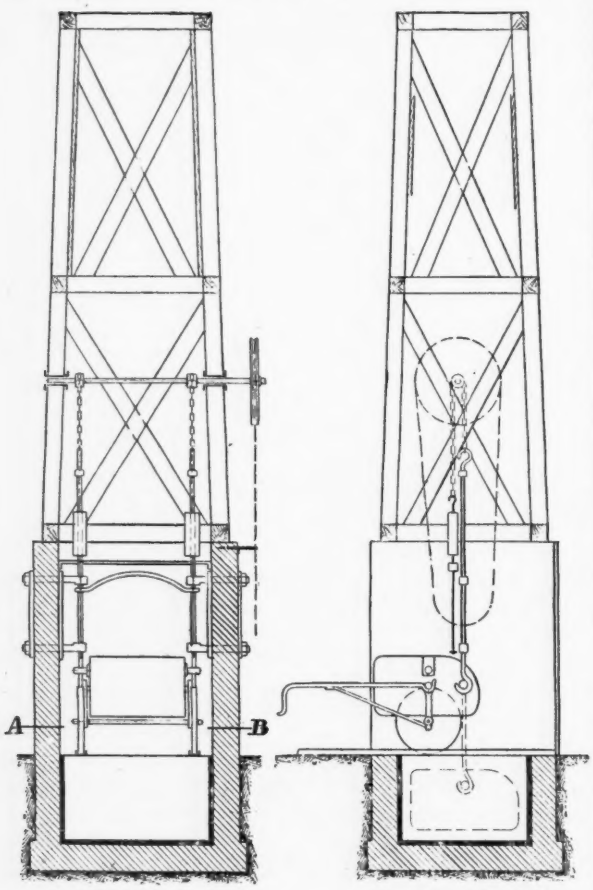
six different points along these lines district governors are located, being set for outlet pressures of 10 to 15 inches.

The maximum pressure carried on the compressors is 45 lbs., which by this method of distribution is, of course, the maximum pressure required for any district. It is needed, however, only on line No. 1, at the evening peak during the winter months; and with this pressure at the compressor a minimum pressure of 10 lbs. is maintained within the district. During the time of filling the Pasadena holder, a pressure of 40 lbs. is maintained at the compressor, which with the valve wide open gives a pressure of 1 lb. at the inlet of the governor before the station meters. At this time of year, the maximum pressure is never more than 27½ lbs. for line No. 1, 10 lbs. for No. 2, 4 lbs. for No. 3, and 10 lbs. for No. 4—pressures which permit of ample leeway for any sudden offtake. With the piping arranged so that the compressors can be operated separately or in parallel on any of the four lines, ample capacity is available for maintaining the required pressures with even a very great increase over the present peak consumption; and up to now absolutely no trouble of any kind has been experienced in giving a satisfactory service on all parts of the system.

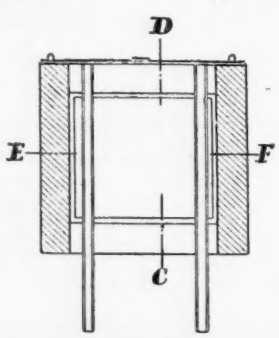
Carefully prepared figures as to the cost of compression, based upon actual working periods and conditions, show that, including operating and fixed charges, it is slightly less than 1·75 c. per 1000 cubic feet.

A NEW COKE QUENCHER.

A new appliance for improving the conditions of quenching coke on gas-works is described by Herr Gülich, of Stendal, in the last number to hand of the "Journal für Gasbeleuchtung."



Section on Line E F. Section on Line C D.



Section on Line A B.

It is pointed out that in the ordinary method of quenching coke, by sprinkling it with water from buckets or a hose, the quantity and quality of the coke suffer. The somewhat tedious, gradual, and often incomplete, quenching thus effected is held to be responsible for an appreciable consumption or loss of coke by combustion. The combustion naturally results in a greater concentration of ash in the residual coke. In order to avoid these unfavourable conditions, an arrangement has been devised to facilitate the rapid and sudden quenching of the coke. It is of the nature of a tower erected over a concrete water-tank. The coke is run into the tower at the ground level, in specially constructed trolleys travelling on rails or in suitable barrows. The body of the trolley or barrow is lifted bodily by means of a suitable appliance mounted in the tower until it is clear of the framework and wheels. The latter are then withdrawn from over the tank, and the body of the trolley is quickly lowered and plunged with its contents into the tank, where it is allowed to remain for about 8 seconds. It is then drawn up, replaced on the framework, and run out to the coke yard. The mechanism for raising the bodies of the coke trolleys is quite simple. It is actuated by hand by means of an endless chain passing over a wheel fixed to the end of a spindle on which are pinions carrying chains, to one end of which are attached the lifting hooks, and to the other end counterpoises.

The resultant coke is said not to be saturated with moisture, and, indeed, if lumps are broken immediately after quenching, their interior is still quite hot. Incandescence and combustion of the whole outer layer are, however, completely stopped. It is explained that this method of quenching causes the red-hot pieces of coke to be covered with a layer of steam, which at once stops incandescence and at the same time prevents too much water being absorbed. According to Herr Gülich, continuous working on the coke from German coals has resulted in an increased yield of 4 per cent. of coke as compared with the former mode of quenching by means of buckets. Chemical examination of the coke shows that it contains less ash, and has a higher calorific power, than that produced in the old conditions.

POWER SUPPLY ON THE NORTH-EAST COAST.

At the Meeting of the Iron and Steel Institute, a paper on "Power Supply and its Effect on the Industries of the North-East Coast" was read by Mr. Charles H. Merz, of London. Apart from the author's special knowledge of the subject dealt with, his paper is of interest from the fact that he was Consulting Engineer to the Walker and Wallsend Union Gas Company (whose new works were opened on the 9th inst., as recorded last week) in connection with the scheme brought forward by them in 1899 for the supply of electrical energy within their district; and he gave evidence on their Bill, as well as before the Select Committee on Power Bills the following year.

The author began by explaining that in the paper the words "power supply" referred to the provision of electricity for industrial use by companies specially constituted for the purpose. He then went on to say that, though of comparatively recent development, power supply had already had a marked effect upon the industry of the north-east coast; and a great saving of coal and reduction of smoke had resulted. There was now, apart from the Power Company, practically speaking, no coal burned on the Tyne for power purposes excepting in the chemical factories. The application of electricity to all new uses had been facilitated. The suburban traffic facilities of Newcastle were more ample than those of any other town of similar size at home or abroad. Four new rolling mills were about to be driven electrically. New industries had been established in the district purely because of the cheap power supply available. A substantial beginning had been made in the utilization of the waste heat and gases existing in the area; and in this regard the district occupied a unique position, owing to the extent to which its future power requirements could be met by electricity produced as a bye-product of two of its largest industries—the making of pig iron and the production of coke.

The station from which the greater portion of the current was now supplied—Carville—was begun in 1903 by the installation of 14,000 electric horse power of steam-turbine driven generators, producing three-phase 40-cycle current at a pressure of 6000 volts. This installation had been increased fourfold during the past four years; so that the generating plant aggregated 56,000 electric horse power, and Carville had now a greater output of electricity than any other public supply station in Europe. From Carville the transmission and distribution networks extended westwards to and through the city of Newcastle-on-Tyne, northwards to Blyth, and eastwards along the River Tyne to North Shields; while in a southerly direction the cables at present reached a point some 30 miles south of Carville, and extensions would shortly be completed linking up the northern network to the power system which had been in operation some eighteen months in the Middlesbrough district.

Mr. Merz next pointed out that a factor invariably of vital importance in the production of cheap current, whether by a public company or by a private manufacturer, is the capital expenditure per useful horse power of plant, inasmuch as this decreases as the size of plant grows, while the running efficiency at the same time increases. The local conditions governing power supply

in the district dealt with are: (1) The low price of coal, enabling manufacturers to produce power themselves at relatively low rates. (2) The fact that the manufacturers' works are mostly of considerable size—*i.e.*, their individual electrical requirements are large. (3) The existence of large quantities of potential energy in the form of waste heat and combustible gas. The first and second conditions have been met by the power companies, in erecting their main generating stations, (*a*) taking full advantage of the best coal and water facilities available; (*b*) by installing plant of capacity much in excess of that which any individual manufacturer, however large, could adopt; and (*c*) by catering for all classes of consumers, thereby securing a diversity of load with a resulting constancy of output, and so utilizing to the best possible advantage the plant installed. These factors, combined with the employment of a highly-skilled technical staff and attention to numberless relatively minor details, have resulted in their securing an efficiency of production much greater than that at all practicable to any manufacturer producing power merely as an auxiliary to his main business.

Power supply in the district began on the north bank of the Tyne. It has naturally, therefore, reached its highest development there; and though, even in this section of the area, it is only seven years old, there is at the present moment, the author stated, not a single firm of shipbuilders or engineers on the north bank of the Tyne inside the Power Company's area of supply who do not take 95 per cent. of all their power from the Company; the remaining 5 per cent. being produced from small gas-engines or from boilers fired with scrap wood. On the south bank of the Tyne, progress has been equally rapid since power supply started; while in the Tees area, though the Power Company only began operations in January of last year, they have already connected over 20,000-H.P. of motors.

Having referred to the electrification of the suburban railways of Newcastle, and the application of electricity to the supply of power to rolling-mills, the author passed on to deal with the saving to be effected by its general adoption in mines. He remarked that the output of coal from Northumberland and Durham in 1906 was upwards of 52 million tons; and, according to the report of the Royal Commission on Coal Supplies, between 6 and 8 per cent. of the total coal brought to bank is used by the collieries for the purpose of power generation. About one-fifth of the coal mined on the north-east coast is converted into coke. Making a liberal allowance, therefore, for the power at present used from the surplus heat resulting from the coking process, the collieries of Northumberland and Durham must burn for their own power requirements some 2½ million tons of coal per annum. As the almost invariable rule is to work non-condensing, as the steam-piping is usually long, and as a large portion of the load is intermittent, it is certain, and has been proved by experience in this district, that the same power can be provided electrically in a large central power station by the consumption of less than a quarter of this coal. Apart, therefore, from the efficient utilization of waste (discussed later), apart from the saving of coal in shipbuilding and engineering works, and apart from the saving resulting from the electrification of railways, the application of electricity to coal mines in this district, when it is as complete as that to the Tyne shipyards, will render available for outside sale more than 1¾ million tons of coal, which is equivalent to upwards of £500,000 per annum. Summarizing present results, the three Power Companies in the district (the Newcastle-on-Tyne Electric Supply Company, the Durham Electrical Power Distribution Company, and the Cleveland and Durham Electric Power Company) are now responsible for the supply of current to 80 miles of (single track) electrified railway, four tramway systems, the lighting in towns having populations aggregating more than 700,000, motive power to the extent of 85,000-H.P., and electro-chemical works of upwards of 12,000-H.P. The last named are new industries, which have been attracted to the Tyne solely by cheap power supply.

These remarks brought the author to what was perhaps the most interesting section of the question he was considering, and one which he thought it was not too much to say was also of considerable national importance—viz., the efficient utilization of waste heat. His observations on this subject were as follows: The counties of Northumberland and Durham and the North Riding of York last year produced together 7,800,000 tons of coke. The bulk of this was made in the older fashioned beehive oven; but the retort type of oven, by virtue of the increased coke yield and of the recovery of the bye-products, is making rapid progress, and it can be proved that were the whole of the above coke output produced in retort ovens there would be available waste gas and waste heat capable of developing more than 150,000-H.P. continuously if used under boilers, or probably rather less than twice this amount, or (say) 250,000-H.P. if the gas were used in gas-engines. The blast-furnaces form a second, but less important, potential source of power. In evidence given before the Royal Commission on Coal Supplies, it was estimated that if gas-engines were used exclusively for power purposes, then, after the requirements of the stoves and blowing-engines had been met, there would be available from the Cleveland furnaces a supply of surplus gas equal to 61,000-H.P. continuously.

The question then arises as to the best method of turning this "waste heat" and gas to useful purpose. The problem is one of great moment, and, however dealt with, will involve years of work before a complete solution can be achieved. It is therefore the more important that the efforts directed towards such a solution should proceed on a commercially sound basis and along correct engineering lines. Many engineers, fascinated by the magnitude of the figures, have proceeded to calculate the commercial value of the gas—the more cautious of them by estimating the total heat units contained in the gas and then calculating the value of the coal necessary to give the same heat units; others by first assuming the gas is utilized in gas-engines, and then calculating the tonnage and value of the coal required to produce the same horse power from steam-engines. The second method gives a result twice as great as the first, which is itself already much too high, having left out of account the fact that the gas or heat in question can only be regarded as of the same value as coal if it can be utilized as cheaply from a capital expenditure point of view, if it can be stored as conveniently, and if it is available just where and when required. In short, the commercial value of the waste products bears no direct relation to their value as arrived at by either of the above methods.

Dealing first with the waste energy from coke-ovens, each separate group of ovens usually consists of between 40 and 120 ovens—rarely exceeding the latter figure. The batteries of ovens are widely scattered throughout the county of Durham, and are for the most part at relatively long distances from the populous centres—that is to say, from the centres of power demand. The gas might be piped to some central point, as is the practice followed in America with natural gas, which is transmitted in some cases 200 miles. But this natural gas has twice the calorific value of coke-oven gas; and it is usually available at a pressure of 50 lbs. per square inch or upwards, rendering it practicable to transmit a large volume of enery through a relatively small pipe, whereas to transmit coke-oven gas any distance there would have to be installed an expensive compressing plant. Further, there is, in addition to the gas given off from the coke-ovens, a certain quantity of waste heat which can only be utilized locally under boilers; and in no calculations which the author has made has he been able to establish a case for the transmission of gas for power purposes as against the alternative of converting the gas into electricity and transmitting the power in this form. Admitting the desirability of converting the gas into electricity, the doubtful point then remaining is whether it is cheaper for an owner of coke-ovens to put down his own generating station and utilize the electricity so produced for his own mines; or, alternatively, to co-operate with a power company, which he can do either by selling them the whole of the gas, and purchasing in return what electricity he needs, or by undertaking to provide a portion of the capital required for generating stations, which, when erected, would be operated by the power company, and the profits shared between the parties.

In all cases investigated by the author, it has been found that a greater profit will accrue to the coke-oven owner by co-operating with a power company than by proceeding on independent lines. There are three reasons for this: (1) When a private owner has to erect a generating plant independently, he must instal some reserve or spare plant, with a consequent heavier outlay of capital than is necessary to a power company, which, possessing a coal-fired station, need not instal spare plant in any of their waste-heat stations, but can instead meet any variation of load by the coal-fired station, which also acts as a stand-by against any breakdown. (2) This necessity of putting down spare plant results in smaller, and therefore more expensive and less efficient, plant. (3) The power company, having a market for current many times greater than the output of any individual waste-heat station, can run such a station continuously at maximum output, so utilizing completely all the current that can be produced; whereas it is impossible to conceive the power requirements of an individual coke-oven and colliery owner coinciding even approximately over 24 hours with the amount of gas or waste heat available.

The power companies in this district having their transmission cables interlacing the entire industrial area, and being in a position, with their large load already developed, to utilize any amount of electricity whenever and wherever it is produced, are arranging for waste-heat stations at different points, turning all the electricity so produced into a common network from which the colliery company, the coke-oven owner, or the blast-furnace owner can purchase any amount he may require—all spare plant and all plant to deal with exceptional peak loads being kept at the main central coal-fired station. Such a policy applied to other commodities is as old as the hills. It began in the most primitive market when a producer gave his raw material and received in exchange manufactured articles. But, so far as the author is aware, this is the first time it has been extensively applied to electricity, though the principle so applied is equally sound; and it appears that only in this way is it possible to conserve the full national value of the energy now being wasted.

To summarize briefly the work which has already been done in the utilization of surplus power, the first co-operative arrangement made by any of the power companies was brought about by the initiative of the owners of the Priestman Collieries, and resulted in the erection of the station at Blaydon in 1905. At the present time the three Companies have at work or in hand five waste-heat stations—three in connection with coke-ovens, and two with blast-furnaces. Additional stations are under consideration.

As regards the Cleveland blast-furnaces, the calculations made dealt with the surplus available on the basis of the gas being utilized in gas-engines. But the adoption of these engines, to the exclusion of all other types of prime mover, still lies some distance

in the future; and in the majority of cases in Cleveland it is found that steam blowing-engines are used, and that after the requirements of the stoves have been met, the gas is practically all expended in raising steam to supply these engines. To free any substantial quantity of gas for outside power users would involve, therefore, the substitution of gas-engines for the existing steam-blowers. Considerations of capital expenditure usually forbid this course; and had it not been for the genius of Mr. Parsons, whose exhaust-steam turbine provides another effective, though less ambitious, way of dealing with the situation, the Cleveland furnaces could not be regarded by a power company as an immediately available source of energy.

The author is aware that it has lately become the fashion to argue that the resources of Great Britain have been developed on less scientific lines than those of either Germany or America. He thinks, however, that the persons urging these views are, in the majority of cases, omitting to give full weight to local conditions. The fact that the connections to the local power companies' systems have recently been increasing at the rate of 20,000-H.P. per annum appears to him to prove fairly conclusively that manufacturers on the north-east coast are quick to avail themselves of new developments or of additional facilities.

CLEANING WATER-MAINS AT PITTSBURG.

In the "JOURNAL" for the 22nd ult., it was mentioned that the cleaning of water-mains in order to increase their capacity was again receiving attention in America, after remaining for some years in abeyance. At the recent meeting of the Central States Water-Works Association, a paper giving the results of some cleaning operations carried out at Pittsburg was read by Mr. C. O. Daughaday, the Assistant-Engineer of the water-works in that city. It has been published in "Engineering Record," from which the following particulars are extracted.

The city of Pittsburg first took up the cleaning of mains about two years ago. The pressure in part of the Hazelwood territory for five or six years kept gradually decreasing. This territory was served by an 8-inch supply main, about fourteen years old. At the end of this main the pressure was 34 lbs. below the theoretical static head. A thorough survey was made of the main by means of pitometers; but no leaks could be discovered. In making these tests, it was found that a coating of scale on the inside of the pipe greatly reduced the diameter. It was therefore decided to clean the main as an experiment; and the contract was entrusted to a company who had given special attention to this kind of work. The scale taken from this pipe was carefully measured, and from this it was estimated that a coating of 0·32 inch covered the entire last section of the cleaned pipe, varying from $\frac{1}{8}$ inch to $\frac{3}{4}$ inch at different places. The results of the cleaning operation were as follows:—

	Before Cleaning.		After Cleaning.
Diameter, inches	7½	..	8
Velocity, feet per second	5·3	..	10·3
Discharge, gallons per minute	730	..	1620
Increase, per cent.	—	..	121

There were 3264 linear feet of this main cleaned; the discharge being taken by means of a 6-inch meter.

As the city had trouble in the dropping of the pressure in the Oakland district, where the mains were mostly old, it was decided to clean some of these. The work was taken up a short time ago, and was nearly completed when the author read his paper. The following are the results of these operations:—

	Before Cleaning.		After Cleaning.
Diameter, inches	5½	..	6
Coefficient of velocity, per cent.	71	..	85
Velocity, feet per second	4·26	..	11·56
Discharge, gallons per minute	370	..	1019
Increase, per cent.	—	..	175

The velocity and discharge in this case, as in all other tests of mains cleaned this year, were determined by means of pitometers. The coefficient of velocity is the ratio between the average and the maximum velocity of the pipe.

	Before Cleaning.		After Cleaning.
Diameter, inches	5½	..	6
Coefficient of velocity, per cent.	76	..	90
Velocity, feet per second	3·71	..	7·6
Discharge, gallons per minute	252	..	671
Increase, per cent.	—	..	166

There were 1800 linear feet of this line cleaned.

	Before Cleaning.		After Cleaning.
Diameter, inches	5½	..	6
Coefficient of velocity, per cent.	79	..	88
Velocity, feet per second	6·38	..	10·47
Discharge, gallons per minute	563	..	923
Increase, per cent.	—	..	64

There were 864 linear feet of this line cleaned. The main was comparatively new, and the inside was in fairly good condition, as will be seen by the coefficient of velocity being 79 per cent. before cleaning. This would account for the smaller percentage of increase compared with the other mains cleaned.

An interesting test was made in connection with the cleaning of a 4-inch main to ascertain the relation of the percentage of increase to the length cleaned. The flow was determined through the full length (1834 feet) before cleaning. The pipe was then broken at 905 ft. 6 in., and the flow determined; then at 477 ft. 6 in., and the flow determined. After cleaning, the process was reversed. The following are the results:—

At 1834 Feet.

	Before Cleaning.		After Cleaning.
Diameter, inches	2⅝	..	4
Coefficient of velocity, per cent.	77	..	85
Velocity, feet per second	3·26	..	9·80
Discharge, gallons per minute	128	..	384
Increase, per cent.	—	..	200

At 905 Feet 6 Inches.

Diameter, inches	2⅝	..	4
Coefficient of velocity, per cent.	73	..	82
Velocity, feet per second	4·09	..	12·41
Discharge, gallons per minute	160	..	485
Increase, per cent.	—	..	203

At 477 Feet 6 Inches.

Diameter, inches	2⅝	..	4
Coefficient of velocity, per cent.	72	..	83
Velocity, feet per second	5·24	..	15·67
Discharge, gallons per minute	203	..	614
Increase, per cent.	—	..	199·50

Another interesting test was made on a 4-inch line before and after cleaning; the line having been laid about forty years. At some places the opening was nearly stopped up by tuberculation. The following are the results:—

	Before Cleaning.		After Cleaning.
Diameter, inches	2¼	..	4
Coefficient of velocity, per cent.	47	..	76
Velocity, feet per second	2·19	..	14·58
Discharge, gallons per minute	86	..	571
Increase, per cent.	—	..	564

As will be seen from these tests, the percentage of increase varies from 64 to 564. This determination of percentage of increase simply tends to show how dirty the pipes were when cleaned. What would be a better result would be to obtain the percentage of maximum carrying capacity of the mains after cleaning. It would be well, as experiments tend to show that the cleaning of water-pipes is a saving operation, for a water company or municipality to instal a hatch-box for cleaning when the pipes were first laid, so that the interior surfaces could be examined from time to time, and also to put in a pitometer tap, and test the lines when first laid, in order to determine their maximum carrying capacity; then, when pipes were cleaned, bring them back to a reasonable percentage of maximum carrying capacity, as found in the new pipes for (say) the first year.

Practical Demonstrations of "Coalexld."

In the "JOURNAL" for the 28th of April last, we called attention to a new fuel which Mr. James Jowett, of Bolton-le-Sands, had patented and brought out under the name of "Coalexld." It is in reality gas-retort coke improved by the application of a chemical mixture to the coal before carbonization; the result being the production of a fuel which it is claimed burns freely in an ordinary household grate, is practically smokeless, and free from sulphur, while its heating power excels that of ordinary coke or household coal. The fuel has been tried by Mr. S. R. Ogden at Blackburn, who bears out the claims of its discoverer in reference to it. "Coalexld" was burnt in the County Hotel, Ulverston, all last winter; and the Manager found its properties to be excellent, being, he says, "free from dirt, smokeless, and exceedingly economical," while the heat was far greater than that obtained from ordinary coal. The object Mr. Jowett wished to attain was, as we pointed out on the occasion referred to, to devise some simple method of treatment whereby in gas-works a smokeless fuel could be obtained which could be offered to the public as equal in quality to, but far cheaper than, one which has lately been put upon the market and much advertised. As this is a matter in which gas managers are greatly interested, Mr. Jowett has invited them to witness some practical demonstrations of the advantages of his fuel which are taking place this week at 9, Skipton Street, Morecambe. Some preliminary trials were made with it a few days ago; and we are informed that a fire was kept going in an ordinary grate for twelve hours at the cost of 1d., reckoning "Coalexld" at 9d. per cwt. All the clinker usually found in ordinary gas coke was, we are told, entirely broken up, and the fuel burnt completely away to the bottom as if it had been best coal. A Company has been formed to exploit the new fuel; and we trust the demonstrations now in progress will have the effect of proving and making more widely known the many advantages claimed for it. We shall give next week the results of the trials.

Midland Association of Gas Managers.—As already announced, the autumn general meeting of the Association will be held at the Grand Hotel, Birmingham, next Thursday. There are three papers on the *agenda*, dealing with the following subjects: "High-Pressure Distribution," by Mr. C. H. Webb, of Stourbridge; "Cultivation of Slot-Meter Consumption," by Mr. S. O. Stephenson, of Tipton; and a "Continuous Recording Calorimeter," by Mr. R. H. Bradbury. At the close of the meeting, there will be high tea.

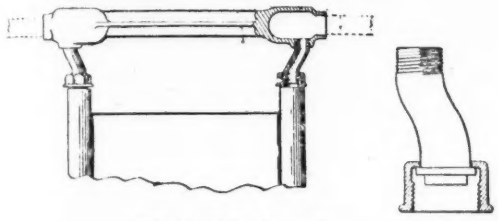
REGISTER OF PATENTS.

Meter Connections.

M'KEE, G. W., of Detroit, Michigan, U.S.A.

No. 21,212; Sept. 24, 1907.

This invention consists in connecting both meter terminals to what is called a "coupling head" and rigidly connecting the service and supply pipes to the coupling head instead of to the meter. The coupling head thus acts as a rigid connection and distance-bar between the meter couplings and relieves them of strain. "Besides the use of lead pipe is entirely obviated, thereby reducing not only the cost of making all connections, but also doing away with the annoyance caused by having the lead pipe connections stolen while the meter is removed."



M'Kee's Meter Connections.

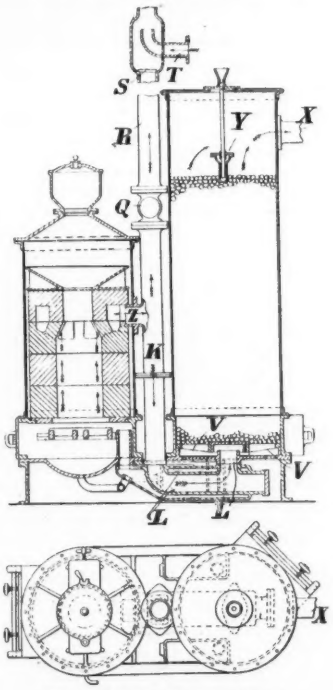
The illustration shows the preferred form of applying the invention; also a detached sectional elevation of the offset coupling stud used with the connection.

Suction Gas-Producer.

LEWIS, D., and BRIGGS, M. (Lewis Gas-Engine and Gas-Producer Company), of Llanelly.

No. 25,896; Nov. 22, 1907.

The inventors employ a cast-iron combination bed-plate to carry the complete plant (including the generator, scrubber, hand fan, piping, and other parts) and to enable the ash-pit door and scrubber door to be arranged in any position. The ash-pit water pan and the scrubber base pan rest upon circular faces on the bed-plate, and carry an ash-pit ring and a scrubber base ring, which (in turn) carry the generator shell and scrubber shell. All these are bolted together by pins placed in equally-spaced holes, the object of which is to allow the ash-pit door and the scrubber door (located in their respective rings) to be placed in as many different positions as there are holes in the circular faces of the bed-plate without interfering with the position of the plate itself or the generator and scrubber shells.



The Lewis Suction-Gas Plant.

The vaporizer is heated by the gases on their way to the scrubber by a pipe K between the generator and scrubber, and by a tubular connection L leading through the bed-plate and scrubber base-ring. The water for raising steam in the vaporizer is maintained at a constant level by the waste water in the scrubber seals. This, say the patentees, is "of importance, as the waste water from the scrubber has already been heated to a fairly high temperature, and, further, no fresh water is required for the vaporizer, thereby reducing the water required to a minimum." Air and steam mix in the vaporizer and are led into the ash-pit. The ash-pit water pan may also be fed with water from the scrubber water seals.

The fire-bars are capable of being drawn straight out through the ash-pit door. By this arrangement "an otherwise necessary fire-hole door is done away with, as by withdrawing the fire-bars the fire will be deposited in the ash-pit water pan, whence it can be easily drawn through the ash-pit door."

In order to prevent the fire going "dead" when the engine is working on a very light load, a valve Q may be partly opened in a draught-pipe R connected to the upper part of the pipe K, and of sufficient length and diameter to cause a strong natural draught. The result is that a continual stream of gas passes to the atmosphere, only to cease when the governor on the engine opens the gas-valve. At this moment a reduction of pressure takes place throughout the plant, and a certain amount of air is drawn in at the top of the draught-pipe R, only to be expelled again by the natural draught immediately the valve on the engine is closed.

There is a supplementary tubular arrangement having another valve S, arranged higher up in the draught-pipe R in such a way that when the engine gas-valve is shut, and there is no reduction of pressure in the plant, the valve S is kept open by the passage of the natural draught; but immediately the engine gas-valve is opened and a reduction of pressure takes place, this valve is drawn on to its seating, thereby preventing air from entering the plant and forming an explosive mixture. This supplementary arrangement may be provided with a pipe T, which discharges either a part or all the exhaust gases from the engine into a casting forming an enlargement on the draught-pipe R, thereby "maintaining a fully incandescent fire."

Coke as a filtering material is placed in the scrubber shell upon a grid V, which has a cap to prevent water from finding its way into the inner tubular connection L of the vaporizer. Sufficient space may be left at the top of the scrubber to form an expansion chamber, and the gases are led to the engine by the usual pipe X. A sprayer Y, combined with a water seal, is fed with water by a funnel secured to the cover of the scrubber.

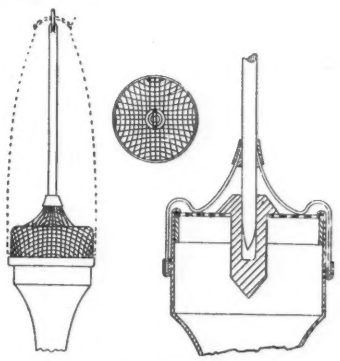
The generator shell is lined (as usual) with fire-bricks; but in the latter is an annular passage near its upper part connected to the central fire space by openings and connected to the draught-pipe R and pipe K leading to the scrubber by another opening Z. By this arrangement very little metal, if any, comes in actual contact with the incandescent fuel. The air, before mixing with the steam in the vaporizer, is heated in its passage through ports into the vaporizer by coming in contact with the pipe K.

Supporting Incandescent Gas-Mantles.

KRIEGEL, M., of Edgbaston, Birmingham.

No. 1026; Jan. 16, 1908.

This invention refers primarily to mantles carried by an internal crutch or pillar, or the like.



Kriegel's Gas-Mantle Supporter.

The inventor uses ordinary metallic wire gauze (instead of cross bars), and makes the gauze support of cup shape, but inverted, so that its downward circumferential side forms the support to the lower part of the mantle. The central part of the gauze cup is adapted to receive the lower end of the crutch, so that it passes through it for support.

The great advantage is said to be secured, that the wire gauze lasts considerably longer, by reason of the fact that the flame commences at a higher point—that is to say, apparently the gas does not ignite as it leaves the burner, but at its passage through the gauze; and by reason of the portion of the gauze opening sideways, the gas also issues there, and is ignited—causing the heat to be thrown sideways upon the mantle in addition to the upward direction. It is stated that, although the main body of the flame is carried higher than usual, incandescence is obtained upon the mantle at a lower point than usual.

Lubricating Gas-Exhausters.

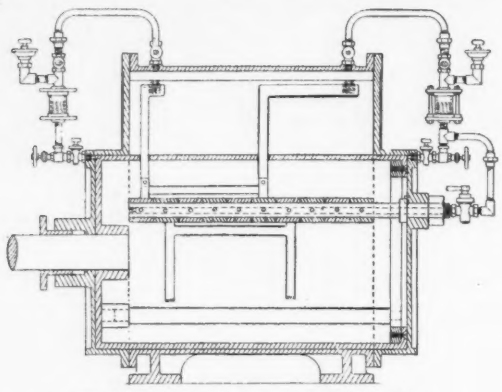
SHUTTLEWORTH, A., of Bolton.

No. 2508; Feb. 4, 1908.

This invention is designed to lubricate the ends of the drum or cylinder carrying the blades of the exhauster, also the joints and ends of the blades and the carrying shaft or centre. A further object is to dispense with the force pumps employed hitherto for the lubricating of exhausters by forcing the lubricant by means of the pressure of gas contained in it.

This is effected by employing a "sight-feed" lubricator consisting of a glass cylinder provided with tight-fitting metallic ends held in position by adjustable standards or supports. The lubricant cylinder is coupled to the side of the outer cylinder or casing by either a pipe, elbow, or tap; the other or top end of the lubricant cylinder having

inlet taps or valves and pipes leading from the upper or top side of the cylinder of the exhauster. The latter pipes are provided with means for charging the cylinder with lubricant when necessary, during which action the taps connecting them to the exhauster are closed.



Shuttleworth's Gas-Exhauster Lubricator.

In ordinary gas-exhausters the stationary centre shaft has been made solid, but here it is made hollow, with one end closed by a screwed plug. The shaft has holes in it communicating with a central longitudinally formed hole, and on it are mounted bosses, each provided with an arm to which is secured the arm carrying the blade. The holes in the shaft are so disposed that they convey lubricant from the central hole to each boss. For the purpose of charging the shaft with lubricant from the "sight-feed" lubricator, a pipe is provided with the T-piece, to which is secured a pipe coupled to the end of the hollow shaft.

When it is desired to supply the "sight-feed" lubricator with lubricant, the tap above the oil container is shut, after which the screwed stopper above the oil-funnel is removed, so as to allow lubricant to be poured in. After the stopper has been replaced and the tap opened, the lubricant will be forced from the lubricator a desired to the periphery of the internal drum or cylinder, and thence passed to the stationary hollow centre or shaft, so as to lubricate the bosses carrying the arms and the blades in their rotary action in the outer drum or cylinder. The latter is provided with valves to allow of the pressure of the gas in the exhauster being shut off from the lubricating apparatus to permit of repairs and the like, or for regulating the pressure of gas to assist in forcing the lubricant (assisted by its own weight against the internal pressure) into the exhauster to lubricate it.

Treatment of Sulphur Dioxide and Sulphuretted Hydrogen to Obtain Sulphur.

FELD, W., of Zehlendorf, Germany.

No. 2719; Feb. 6, 1908. Date claimed under International Convention, March 6, 1907.

The patentee, in the course of a lengthy specification, says: In the known oxidation of sulphuretted hydrogen by sulphur dioxide, both gases are passed together through liquids—the reaction $2H_2S + SO_2 = 3S + 2H_2O$ taking place. Hitherto this reaction has not been complete, and the yield of sulphur has been very low; polythionic acids being produced, and partly decomposed by the sulphur dioxide evolving sulphuretted hydrogen, and also an important part of both gases escaping the mutual reaction—this being more especially the case when the gases are diluted. It has been proposed to increase the yield in sulphur by passing the gases through a solution of magnesium chloride; but this has not proved efficient—the sulphur obtained being amorphous, difficult to filter, and of little value, as compared with ordinary sulphur.

According to this invention, the reaction, in accordance with the above equation, is made complete by passing the gases through liquids which have the power of dissolving the sulphur produced by the reaction. The formation of acids of sulphur of any kind is thereby almost completely prevented.

Any liquid which has the power of dissolving the sulphur produced can be used as the reaction agent—either in a cold or a heated state. The most suitable liquids for the purpose are the so-called tar oils obtained by the distillation of organic matter, and consisting of mixtures of hydrocarbons; the tar-oils being especially suitable if they be heated before being used. On the sulphuretted hydrogen and sulphur dioxide being passed through the oils, the oils are heated considerably by the heat liberated by the reaction, thereby greatly increasing the power of the oils in dissolving sulphur. The ease and completeness of the reaction appear to be due (according to the patentee) to the fact that the sulphur dissolved in the oil is prevented from forming thiosulphate and polythionic acids with the water resulting from the reaction. The gases are preferably passed through the reaction liquid until it is saturated with sulphur. The reaction is complete when a large amount of sulphur has crystallized out of the solution, and is preferably stopped as soon as the liquid becomes pulpy, on account of the amount of crystallized sulphur. The introduction of the gases can, if desired, be stopped before the liquor is saturated with sulphur; this being indicated as soon as the formation of oxygen compounds of sulphur begins to take place in the liquid. The oil containing the sulphur is allowed to cool in crystallizing vessels, and the sulphur is obtained in pure crystals—larger or smaller, according to the temperature and the degree of saturation of the oil. The crystals are preferably separated from the solvent in a centrifugal apparatus; and, for the purpose of separating from them the adhering oil, they are washed with a suitable medium—such, for instance, as steam.

In using pure solvents, the action between the sulphuretted hydrogen and the sulphur dioxide is comparatively slow; but it is, with less liquid, more rapid if crude, commercial tar oils be used. Investigation has shown that the acceleration of the reaction is due to the presence of organic nitrogenous bases in the crude oils. These bases form, with the sulphur dioxide, compounds which decompose again on the solvent being heated. It has been found that the reaction takes place in the presence of these bases more quickly when the reaction liquid is heated nearly to (or even above) the temperature of decomposition of the sulphites of the bases. These bases, therefore, act as transferers for the sulphur dioxide. In accordance with this observation, it has been found that the organic or inorganic substances suitable for increasing the rapidity of the reaction according to this invention are those which combine with sulphur dioxide, or sulphuretted hydrogen, and which compounds, when heated with liquids, again become decomposed. Among these accelerating agents are the aromatic amines, amides, nitriles, thio-amides, and the like, as well as the compounds of the aliphatic series, whether of a basic or a weakly acid character or not, and other organic substances having, or containing, substances of the property named—such as oils obtained in the distillation of ordinary or brown coal, shale, peat, bones, and the like, which contain pyridine bases.

In using, in addition to the reaction liquids, a basic substance of the character named, it often occurs that, after repeated use, the activity of the liquid decreases; this being due to the secondary formation of fixed oxy-acids of sulphur—such, for instance, as sulphuric acid. The sulphur dioxide always contains small amounts of sulphur trioxide and sulphuric acid; and these form sulphates with the basic compounds used to increase the reaction. If, for instance, the tar bases (containing pyridine bases) be used to increase the activity of the liquid, sulphates of these bases are produced. As soon as the bases are converted into sulphates, the increase of the reaction ceases. By decomposing the sulphate of the bases, the bases are regenerated. For this purpose, there may be added to the reaction liquid any substance capable of converting the inactive sulphates into compounds capable of increasing the activity.

The following is an example of a way of carrying out this invention in which heavy tar oil is used as the reaction liquid. The heavy tar oil accumulates the greater part of the nitrogenous bases (pyridine bases and others) contained in the tar. So as to increase the rapidity of the reaction, a further amount of tar bases may be added to the oil; and in order to bind sulphuric acid which may exist in the sulphur dioxide, a substance, such (for instance) as sodium carbonate, is added. The oil thus prepared is then heated to 40° C., and at the same time sulphur dioxide and sulphuretted hydrogen, or gases containing them, are introduced. In order that no sulphuretted hydrogen shall escape, so much sulphur dioxide is supplied that at least one molecular proportion of sulphur dioxide is present for each two molecular proportions of sulphuretted hydrogen. An excess of sulphur dioxide does no harm, as the liquid absorbs it. Such excess is even desirable if sodium carbonate be used, to avoid the formation of thiosulphate from the sodium sulphite. If desired, the liquid may first be saturated with sulphur dioxide and then sulphuretted hydrogen introduced; these operations being repeated alternately until the liquid is saturated with sulphur and the sulphur crystallizes out. The liquid becomes so strongly heated by the reaction that finally the water generated in the reaction is evaporated. The oxidation of the sulphuretted hydrogen is complete even when it is very diluted. After the liquid contains, for every 100 parts thereof, from 50 to 60 parts of sulphur—partly dissolved and partly separated in crystalline form—the supply of the gases is stopped, and the liquor is allowed to cool. The sulphur crystallizes in the shape of strong, well-coloured crystals which contain the sodium sulphate formed, together with undecomposed sodium carbonate. The sulphur is preferably separated from the solvent in a centrifugal machine, and is then treated by steam. The condensation water dissolves the sodium compounds, while the steam removes the adhering oil, which is recovered by condensing the steam, and can be used again in the process.

If it be desired to avoid loss of sodium in the form of sodium sulphate, the oil is used without the addition of sodium carbonate; and, after the reaction is finished, the sulphur is allowed to crystallize. The mother liquor, after being mixed with the liquor obtained in washing the sulphur by steam, is treated with milk of lime. Insoluble gypsum separates while the regenerated tar bases are dissolved by the oil.

If the gases to be deprived of sulphuretted hydrogen contain also ammonia, it is not necessary to add to the reaction liquid a binding medium for the sulphuric acid; but it is necessary to provide means to keep the liquid acid. It is then preferable to use as the reaction liquid a fraction of the tar distillation which is rich in phenols, and therefore possesses a weak acid character. Carbolic acid can also be employed as the reaction liquid—tar bases being added for the purpose of increasing the rapidity of the reaction.

If desired, ammonia gases can be passed through the liquid together with the sulphur dioxide and sulphuretted hydrogen, or the gases may be passed through in succession.

The examples given deal only with a few of the cases possible; but from them it will be easy to determine the most favourable conditions for each special case.

Discharging Gas-Retorts.

DRAKES LIMITED, of Halifax, and HOLLANDER, C., of Manchester.

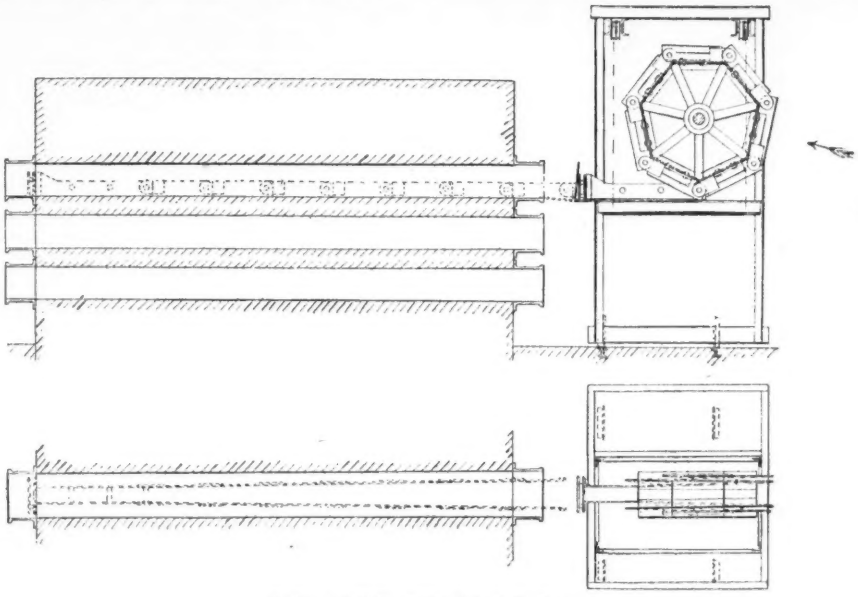
No. 2553; Feb. 5, 1908.

This retort invention has special reference to discharging apparatus wherein a sectional or jointed push-bar is made use of—the sectional parts or links being so jointed together as to form a rigid bar when advancing through the retort, while when being withdrawn they may be wound around a drum. The object of the invention is to construct the sectional parts of the push-bar and hinge (or pivotally connect them together) in such a manner that on being wound around the drum their diameter is "not increased although two or more coils may be wound thereon, while the direction of thrust is always in alignment with the longitudinal centre of the distended links and parallel with their path of motion without necessitating the transmission of lateral motion to their actuating drum during the time it is being rotated. By the same

method of construction, it is claimed that the surface of the base of the retort over which the bar has to slide is not worn away or deteriorated so rapidly as when jointed bars are employed.

The illustration shows a part sectional side elevation of the apparatus, and a view of parts as seen from above.

The push-bar (which has the usual end push-plate mounted on it) is made in pairs of links; each pair being held apart by cross-stay-pieces and by their attachment to the drum, so that their rear ends are a greater distance apart than are the advancing ends. Thus when the whole series of links is connected together, all the links in each series are in alignment with each other, yet one series is at an angle to the other series, as well as being at an angle to their path of motion indicated by the chain line. In this manner the two series of links may be said to assume the form of a "truncated isosceles triangle" in contra-



Drake and Hollander's Retort Discharger.

distinction to a parallelogram, as is the case when both series of links are parallel to each other.

The links which are held apart by the stay-pieces may have their stay-pieces to form their pivotal connections; while the links which are not so held apart have pivotal pins or studs as their mountings. And as the links have to be wound upon the drum, the stay-pieces are only used on such a number of them as will make up the last coil. Thus the space between the other coils of links is free of them, to enable the last coil to lie in its proper position upon the periphery of the drum.

The drum upon which the series of links forming the push-bar are to be mounted, and by which they have to be moved into and out of the retorts, is so constructed—by having guiding and engaging plates or projecting flanges upon its periphery—that, by the rearmost links being coupled to the drum, on this latter being rotated all the links of both of the series will be wound thereon or unwound therefrom as the case may be; and as the series of links are at an angle to their path, on being wound upon their drum their courses will be in the form of a double spiral, so that each succeeding coil of links will fall upon the periphery of the drum and lie between the preceding coil. Hence the outer diameter of the coils of links when wound on the drum is the same whether there is only one or two or more of such coils thereon.

By the pivoted links being in the relative positions described, as they are moving through the retort each succeeding pair of plates will travel over a different part of the retort's surface which supports them. Hence the retorts are not worn into grooves or furrows "as is the case when the series of plates are in alignment with their path of motion."

Removal of Air from Gas-Pipes.

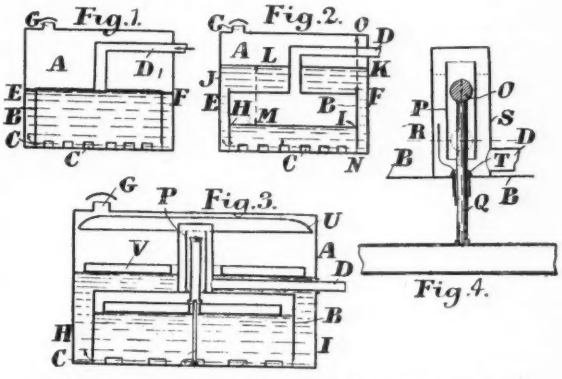
DELAGE, M., and WOOG, P., of Paris.

No. 11,793; May 30, 1908. Date claimed under International Convention, June 1, 1907.

The apparatus which forms the subject of the present invention is for automatically expelling air from gas-pipes without allowing the gas to escape into the atmosphere—comprising a closed chamber in free communication with the end of the pipe and means such that its capacity can be increased under the influence of the pressure of the gas by the volume it is desired to expel from the pipe.

The apparatus consists of a receiver A (fig. 1) containing a bell B fixed to the bottom. Communication between the interior of the bell and the receiver takes place through holes C. A tube D leads gas into the bell B. The receiver is filled with water, petroleum, heavy oil, &c., to the level E F. Fig. 1 shows the apparatus at rest. The receiver communicates with the atmosphere through an opening G. The apparatus is connected through D to the end of the pipe system, from which it is desired to expel the air. The pipe D, in order not to lessen the speed of the expulsion, is at least equal in size to the pipe. When the main cock of the pipe system is opened, the pressure of the mixed air and gas coming in through the pipe D depresses the liquid in the Bell B to the level H I (fig. 2), and causes it to rise in the receiver A (as shown in this figure) to J K. The liquid then occupies the whole of the portion in fig. 2 shown by the horizontal hatching. The height L M balances the pressure of the gas.

The capacity of the bell B from the top to the level H I should be such as to produce a satisfactory expulsion of air from the pipe system. It should be at least equal to the capacity of the pipe between the main cock and the apparatus; and it is advantageous that it should be of greater capacity—equal, for example, to one-and-a-half or twice that of this pipe. On the other hand, the height F N of the bell should be sufficient to preserve a certain reserve of liquid I N when the apparatus is full of gas; and the height F O should, of course, be greater than the height K F of the forced-back liquid. When the main cock is closed, the pressure in the pipe diminishes by reason of the escape of gas through the burners; and the gas contained in the space between E F and H I of the bell passes little by little into the pipe until the liquid has again resumed its level E F.



Delage and Woog's Apparatus to Expel Air from Gas-Pipes.

When the apparatus is intended to empty a pipe supplied with gases under pressure, it might happen that, by reason of damage to the pressure-reducing apparatus, the pressure of the gas is abnormally increased. In this case, the reserve liquid I N might be insufficient, and the gas would escape into the atmosphere below the bell B by passing through the liquid. In this case, it is preferable to adopt a safety arrangement consisting of a valve closing automatically when the pressure reaches a value greater than normal. Thus the gas inlet-pipe D (fig. 3) is connected to the bell B by a vertical portion, within which moves a rod carrying a valve which can close the inlet leading gas to the bell. The valve-rod is connected to a float which rises and falls with the liquid. When the float is near the top of the bell, the inlet passage is free, and remains so during the expulsion operation. The height of the rod is such that closing takes place only if the level of the water falls below the normal position H I.

A modification of this apparatus which prevents the valve from being merely partially closed by reason of its being out of centre consists in constructing this valve of a metal sphere O (fig. 4) sliding freely within a tube P, itself placed within the gas inlet-tube to which it is connected by ties. A rod Q, supported by the float, pushes the sphere when the float is at the top of its travel. When by reason of the inlet of gas the level of the liquid is lowered in the bell, the float falls, and with it the rod Q, to the level R S, at which level the sphere still leaves the gas inlet D free. If any abnormal pressure is produced, the float falls still more, and leaves the sphere free. It then rests upon the seating T and closes communication between the pipe and the bell.

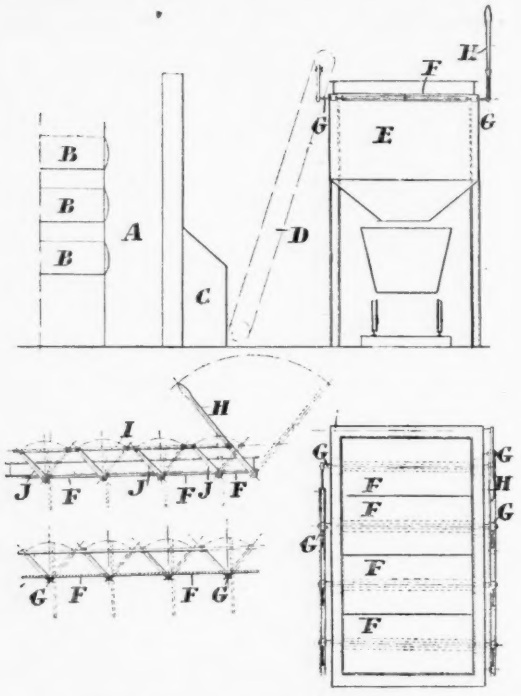
Quenching Coke.

DUNAL, C. F. R., and MASSE, R., of Gennevilliers (Seine), France.

No. 8508; April 16, 1908.

This invention relates to an apparatus by means of which the complete extinction (without the use of an excess of water) and the drying of the coke during the period following the unsealing of the retorts can

be ensured on the apparatus from which the coke is discharged into trucks or the like. "The immediate and final charging of the coke, as it issues (without having been sorted) into the trucks, with or without previously arranging it in stacks, is thus rendered possible."



Dunal and Masse's Coke Quencher and Loader.

The illustration shows diagrammatically the complete apparatus in vertical cross-section and plan, showing one platform only; an elevation showing details of the control of the balance-plates; and a detail view of the system of pivoting the plates.

C is an intermediate receptacle receiving the coke after the opening of the retorts; and D is an elevator to convey the coke to the charging apparatus E. But if the retort-house is at a sufficiently high level, it will be possible to do away with the hoist and discharge the coke directly by means of an inclined plane on to the plates of the apparatus.

As illustrated, the charging apparatns E is provided with a balance platform, consisting of a number of sheet-metal or cast-iron plates F, each of which is capable of pivoting and turning about a transverse pivot pin G, arranged either in their centre, as shown, or at any other suitable point. A lever H connected to a bar I, which itself connects together the rods J secured to the pivots G, enables the attendant, by suitable oscillation, to turn all the plates of the platform at the same time.

The operation of the apparatus is as follows: The plates F having been fixed in horizontal position, the coke removed from the retorts, and moistened in extinguishing hoppers (not shown), arrives on the platform either directly by means of an inclined plane, a hoisting apron D (as shown), or by a bucket. It is then, with a rake or mechanically, spread in a thin layer over the whole surface of the platform. This is an essential condition for extinguishing the internal combustion without excess of water and for drying. The period of the spreading process in the air would vary according to circumstances and to the conditions under which the operation is effected.

APPLICATIONS FOR LETTERS PATENT.

21,016.—Cannon, D. W., "Gas-stoves." Oct. 6.

21,088.—Jones, C. J., and Still, W. M., "Controlling the supply of gas to burners." Oct. 6.

21,117.—Lindsay, J. R., and Earnshaw, W., "Economizing gas." Oct. 7.

21,169.—Cross, W., and Son, Ltd., and Kirby, J. I., "Gas-regulators." Oct. 7.

21,175.—Williams, A. A. V., "Production of gas." Oct. 7.

21,185.—Tourtel, J. M., and Mealing, W. R., "Controlling gas-lights from a distance." Oct. 7.

21,216.—Hewitson, T. M., "Compressed-gas appliances." Oct. 8.

21,264.—Stephens, K., and Challis, J., "Atmospheric burners." Oct. 8.

21,361.—Schwager, A. C., and Hollander, J., "Thermal gas cut-off device." Oct. 9.

21,362.—Palmer, L. W., "Acetylene generators." Oct. 9.

21,394.—Roberts, G. E., and Sullivan, J. C., "Blow-pipes for burning gas-mixtures." Oct. 9.

21,409.—Keith, J. & G., "Electrical ignition of gas-lamps." Oct. 10.

21,419.—Liversedge, A. J., "Indicating and recording the cleanliness and purity of gases and gas pressures." Oct. 10.

21,453.—Davis, H. N., and Twigg, W. R., "Radiators or other heating stoves heated by gaseous fuel." Oct. 10.

21,489.—Gennotte, E., "Gas-retorts." Oct. 10.

21,507.—Köhler, H., "Gas-lamps." Oct. 10.

LEGAL INTELLIGENCE.

UNLAWFULLY CONNECTING A WATER-PIPE.

High Court of Justice—King's Bench Division. Thursday, Oct. 15.

(*Before the* Lord Chief Justice *and Justices* Bigham *and* Walton.)

To-day their Lordships had before them a case stated by Mr. Fordham, one of the Metropolitan Police Magistrates, for the opinion of the High Court. The appellant was Mr. J. B. Kyffin, the owner of Nos. 40 & 42, Dunstan Street, Haggerston, who had been fined 40s. and costs, at the instance of the Metropolitan Water Board, for unlawfully affixing a service-pipe to the main without having their consent, as required by section 19 of the Water-Works Clauses Act, 1863 (26 & 27 Vict., cap. 93). The proceedings in the Court below were reported in the "Journal" for the 5th of May last (p. 301).

Mr. S. A. Kyffin, for the appellant, said prior to the 8th of February each house had a separate communication-pipe supplied direct from the main; but, owing to a defective fitting, causing waste of water in No. 42, notice was given to repair. As no notice was taken of this, the water was cut off. Shortly afterwards the appellant connected the supply from No. 40 with No. 42, contending that he had power to do this under No. 5 of the regulations approved by the Board of Trade in 1872, which provided that in case of a group or block of houses, the rate of which was paid by the owner, one communication-pipe was sufficient. At the Police Court, the Board contended that Nos. 40 & 42 were not a "block or group."

The Lord Chief Justice: Where do you get authority to make the communication with the service-pipe without the consent of the Board?

Mr. Kyffin: Under regulation No. 5.

The Lord Chief Justice: That only says you may have one communication pipe for each group or block; there is nothing which gives you permission to make the connection without the consent or authority of the Board.

Mr. Kyffin argued that the appellant could not exercise an option without coming under section 19 of the Act of 1863, and the regulation referred to justified him in what he had done.

The Board were not represented by Counsel.

The Lord Chief Justice said in his opinion the appeal failed. There were two things to be considered—the right to have a supply of water and the right to physically affix a pipe either to the main or to the service-pipe. In order to have an effective supply and to prevent waste, the control of the method by which the pipe should be connected rested with the suppliers; and accordingly section 19 of the Act of 1863 provided that it should not be lawful for any person to affix a pipe to the service-pipe, or to make any alteration, without consent. Then came regulation 5, on which the appellant relied, giving him a right, at his option, to have one sufficient communication-pipe. If the suppliers refused to give him this, he would have his remedy to compel them to do so; but to say that this justified him in cutting his own pipe, or the suppliers' pipe, and affixing another thereto, would be to hold that section 19 of the General Act was overridden by the regulation. There was no justification for the appellant having thought fit to take the law into his own hand.

Justices Bigham and Walton concurred; and so the appeal was dismissed.

Suicide in a Gas-Oven.—A Wandsworth man was found dead from gas poisoning; and the Coroner's Jury returned a verdict of "Suicide during temporary insanity." The widow said that deceased had suffered from want of sleep and dyspepsia. One morning she awoke, and noticed a strong smell of gas. She went down to the scullery, and found her husband lying on the floor with his head in the gas-oven. There was a towel wrapped round his head.

Dorking Gas Company.—The shareholders of the Dorking Gas Company have confirmed a recommendation of the Directors for the payment of dividends of 6 per cent. on the "A," "B," and "C" shares, and of 5 per cent. on the "D" shares. By these distributions £1337 of the amount available will be absorbed; leaving a balance of £218 to be carried forward. During the past half year, there was an increase of 3·51 per cent. in the quantity of gas manufactured.

Surreptitious Consumption of Gas.—Before the Borough Magistrates last week, Walter Fountain, a coal merchant of Ryde, was summoned for having illegally consumed gas which had not passed through his meter. Mr. W. H. Thirkell, solicitor, conducted the prosecution on behalf of the Gas Company. On the 19th of September, when the defendant's prepayment meter was removed for repair, he refused to have another, saying he preferred to wait; but on the 1st of October an inspector found that by means of an india-rubber tube a stable was being lighted from a gas-bracket in the house. This went on for five days, when a visit was paid by the Manager (Mr. F. F. Farrand). The defendant denied that a warning had been given by the inspector, and made excuse that his son had attached the tube. He was fined 2s. 6d., with 10s. 6d. costs.

Theft of Incandescent Fittings.—A warehouseman named Thomas Willetts was charged at the Birmingham Police Court last Wednesday with stealing 2½ gross of incandescent burners and mantles from the works of Messrs. Wright and Butler, Limited. Mr. Barrow, who prosecuted, said the thefts appeared to have extended over a considerable period; but only two charges would be dealt with. On Sept. 26, it was alleged, prisoner broke into the warehouse and stole six dozen mantles and burners. He appeared to have gained access to the place through a window ventilator, to which he climbed from a shed beneath. Then, having secured the stolen property, he let himself out with the keys. Evidence was given to the effect that prisoner had been seen outside the premises; and Charles Bullock said prisoner sold him a box of mantles on the evening of the robbery. Four burners were found in Willetts' possession when he was arrested. Prisoner was committed for trial at the Quarter Sessions.

MISCELLANEOUS NEWS.

HIGH-PRESSURE INVERTED GAS LIGHTING IN LONDON.

Improved Lighting for Fleet Street.

At the Meeting of the Court of Common Council of the City of London last Thursday, the Streets Committee brought up a report submitting for adoption a scheme for lighting Fleet Street experimentally by means of 16 high-pressure inverted burner gas-lamps, on brackets, at a cost not exceeding the present charge for lighting the said thoroughfare—viz., about £264 per annum. The report, on being put to the meeting, was carried *nem. con.*

The same Committee brought up a recommendation that they be authorized to appoint a deputation to visit certain cities on the Continent for the purpose of inspecting the various systems of public lighting there, at a cost not exceeding £200.

An amendment to refer the matter back to the Committee, for them to bring up the number and names of the deputation, was lost.

Mr. John Stopher, ex-Chairman of the Streets Committee, said, apart from the best form of lighting, the Committee wished to know the best method of adapting the light—whether on standards, brackets, or overhead suspension. He urged that the deputation should be appointed; and the recommendation was carried.

EDINBURGH PUBLIC LIGHTING.

Annual Report of the Inspector.

We have received the report of the Inspector of Cleaning and Lighting to the Corporation of Edinburgh (Mr. Geo. A. D. Mackay) for the year ending the 15th of May last. Though in his introductory remarks to the portion of the report devoted to lighting he states that there was nothing of outstanding interest to note in respect of the year, some particulars are given which are worth reproduction.

In the annual report for 1906-7, it was stated that the flat-flame burner had disappeared, and had given place to incandescent lanterns; and that Edinburgh, with the electric lighting of its main thoroughfares and car routes, its incandescent illumination of its other streets, courts, and closes, and its stair-lights burning from sunset to sunrise, had attained general lighting conditions which commanded the approbation of the citizens and drew forth the commendation of visitors and municipalities. The only change in the situation was a break in the lighting hours, which, in the interest of economy, had been introduced at the instance of the Council. For a number of years the whole of the public lamps and stair-jets were kept lighted all night throughout the year. During the year covered by the report, however, the following changes had taken place in the lighting hours. Only one-half the public lamps were lighted from May 1 to Aug. 31; full lighting being in operation from Sept. 1 to April 30, with darkening of one-half at midnight. The stair-lights burnt to midnight only from April 1 to Sept. 30, and from sunset to sunrise from Oct. 1 to March 31. In giving effect to these alterations, Mr. Mackay says he has loyally carried out the instructions of the Council; but he considers it his duty to note that quite a number of complaints have been received from citizens as to the inconvenience arising from the darkening of one-half of the public lamps at midnight, and also as to the darkness of the stairs at night in the summer months.

On the 15th of May last, the streets of the city were lighted by 10,081 incandescent gas and 1193 electric arc lamps; and the common stairs by 12,395 gas-jets and 152 electric lights. In the previous year the number of gas-lamps was 9940; the increase of 140 being accounted for by additional lighting in areas on the outskirts of the city. The electric arc lamps had been increased by 18; the additional lamps being required to light up tramway extensions. The number of stair lights has gone up by 272, accounted for partly by the erection of new buildings, but mainly due to the demand for improved lighting.

The 10,081 incandescent gas-lamps have a varied consumption; 911 having 2-feet, 6300 having 2¼-feet, and 2870 having 3-feet burners. Mr. Mackay says the 2¼ cubic feet burners "give every satisfaction;" and as those at present consuming 3 cubic feet become worn out, they are being replaced with 2¼-feet burners. It was stated in the previous report that a few experiments had been made in the direction of lighting common stairs by incandescent burners; there being 13 stairs so lighted. There was really nothing of moment to report in this matter; the situation at the close of the period reported upon remaining practically the same as on May 15, 1907.

The following is a summary of the expenditure on public lighting for the year under review :—

Street gas lighting, including cost of gas, with due proportion of lamplighters' wages and incidental expenses	£22,549 10 11
Electric lighting, including incidental expenses	11,246 3 4¾
Stair lighting, including gas, proportion of wages, and other expenses	11,619 1 6¼
Total	£45,414 15 10

The expenditure for 1907-8, compared with that of the previous year, shows an increase of £1814 15s. 9d. This was caused by several factors, the principal of which were an addition to the number of lamplighters, and the appointment of a separate stair-light extinguishing staff (due to a conviction alike on the part of the Inspector and the Committee, that the individual lamplighter had too much to do), the maintenance of the recently converted gas-light installation, an increase in the number of electric arc lamps, and the purchase of a photometer for the gas-testing room in the City Chambers. Mr. Mackay points out, however, in this connection, that, except for a considerable saving in the cost of gas, the result of curtailment in the burning hours of the public lamps and stair-lights, a much greater excess in the lighting expenditure would have had to be recorded. The net expenditure works out to 2s. 7d. per head of the population, compared with 2s. 6¼d. in the year 1906-7.

Mr. Mackay gives tables showing the progress of electric and gas lighting—in the case of the former from 1895-6 onwards, and in that of the latter from 1891—and the variations in the gas-rates during the latter period. The value of the lighting plant, as returned to the City Chamberlain, on the 15th of May last, was £20,208 15s. 4d. The Inspector says the waste of plant is very considerable, not owing to ordinary wear and tear, but through carts and other vehicles coming into collision with the lamps, and not infrequently as the result of malicious mischief on the part of idle boys and night marauders. Breakages are very frequent from these causes; and the replacement of the damaged or broken lanterns and pillars represents a considerable annual expenditure.

THE DEVONPORT GAS-WORKS INQUIRY.

Explanations by Alderman Hornbrook.

The Special Committee appointed by the Devonport Town Council to hold an inquiry respecting the agreement between the Corporation and Messrs. Willey and Co. as to the slot installations in the borough held a meeting last Friday. The Mayor (Mr. R. Smerdon) presided. The Committee sat for about three hours, and had before them the minutes of the Gas Committee, the agreement which they were appointed to investigate, and the correspondence relating to the matter. At the close of their deliberations, they adjourned to a date to be fixed by the Mayor.

In the meantime, the subject is being discussed with considerable feeling by those who are taking part in the municipal elections. Mr. J. Tozer, who was Mayor at the time that the agreement was entered into, and at whose instigation the Special Committee were appointed to investigate it, said in one speech that the loss under the agreement would be at least £1200 per annum for the next five years. This meant practically a rate of 1d. in the pound, or, in the alternative, an increase of 6d. per 1000 cubic feet in the price of gas supplied through slot meters. The latter would be most unfair and unjust, for the slot meters were used mostly by the working classes and poor people, who now paid 3s. 3d. per 1000 cubic feet for the gas consumed. He hoped some compromise would be arrived at, so that the borough would not have to face the responsibility placed upon it by the agreement.

Alderman Hornbrook, the Chairman of the Gas Committee, in a speech at a subsequent meeting, complained that Mr. Tozer, as a member of the Special Committee, was acting as accuser and judge. As to the contracts entered into by the Gas Committee with Messrs. Willey and Co., he said that, taking them all into consideration, the firm was £7000 below any other who tendered; and there was not a single contract except one small one, for which the Engineer assigned a good reason, in which Messrs. Willey's had not been the lowest tender. He never saw the contract respecting the slot meters, and he never knew its terms. It was brought before the Gas Committee, of which he was a member. But in a technical matter of this kind they relied upon the officials; and they had the assurance that it was a good contract. Under the old one which they took over from the Gas Company, they paid for the maintenance of slot installations; but under the contract made by the Committee, they had not paid a penny for this during the past five years. Plymouth had been paying considerably more than Devonport for its installations, until Messrs. Willey and Co., generously and unasked, levelled down the charges to the same as Devonport, though there was still four or five years to run under the contract they had with the Plymouth Gas Company. It had been suggested, said Alderman Hornbrook, that he was a shareholder in Messrs. Willey's business; but he had not, and never had had, the least interest in the firm. He added that the Engineer and he had been negotiating with them; and that they had held two meetings of the Sub-Committee. The firm were considering what concession, if any, they could make to Devonport; so that possibly, after all, they might have done Devonport a good service by that small deputation going to Exeter, about which they had heard so much.

GAS EXHIBITION AT SOUTHPORT.

Last week a gas heating and lighting exhibition of an interesting character was opened at Southport. It was held under the combined auspices of the Gas Committee and the local ironmongers, and included the stoves, radiators, and lamps of six well-known manufacturers. The process of mantle-making was also demonstrated.

Mr. G. L. Hodge, in the absence of Mr. R. M. Iddon, President of the Ironmongers' Association of Southport, said it had fallen to his lot to take the chair, and call upon Alderman Travis to open the exhibition. He felt it was only right, as one of the local ironmongers, to say they had banded together to sell gas-fires to the public at the prices marked on them on the stalls; and the Gas Committee had undertaken to pay for fixing. In former times, when they sold a stove for 25s. or thereabouts, the fixing of the stove frequently came to from 15s. to 20s. It was scarcely necessary to say that the cost of fixing went very much against the sale of stoves; but now the agreement had been concluded with the Corporation, they could see, by looking at the cards on the stoves, what price they would have to pay. Visitors would find that gas-stoves had greatly improved both in utility and in design.

Alderman Travis said the Gas Committee had come to an arrangement with the local ironmongers and plumbers whereby gas-stoves might be fixed at an inclusive charge. When one was purchased from the ironmonger, he fixed the stove, and the cost of the fixing was borne by the Corporation on a scheduled price, which, of course, would vary

with the amount of pipe used. But schedules had been arranged, and there was now no difficulty; and the Corporation, instead of having one show-room to dispose of gas-stoves, had show-rooms up and down the town at all the ironmongers' shops. Their relations with the local trade in Southport were of the most amicable order; and it was in consequence of this that they saw before them that afternoon an exhibition which was to all intents and purposes a joint exhibition between the Corporation and the sellers of gas-stoves. Since the last exhibition, there had been many improvements in designs, and more particularly in efficiency—though perhaps they would notice the improvements in design most of all. The Corporation Gas Engineer, Mr. J. Bond, had been carrying out many tests at their works to see whether they could get everything out of gas-fires for heating a room, and at the same time have all the products of combustion carried away by the chimney. He hoped both those at the stalls and the Corporation, who were selling the gas, would have every reason to congratulate themselves on having held the exhibition. The more gas they bought, the more they would keep down the rates. But there was a difference of opinion as to this. They (the Gas Committee) would like to put down the price of gas; but their friends on other Committees spent so much money that they had to hand over to them £13,000 every year. They hoped they might be able to pay over this sum, and still be able to bring down the price of gas. He added that it was largely through the wisdom and tact of the Engineer that the Gas Committee were now working so pleasantly with the traders.

ROAD-TARRING AND TREE LIFE IN PARIS.

Reports of Injury Contradicted.

Our readers may remember that some weeks ago a statement was made by the Paris Correspondent of the "Daily Telegraph" to the effect that the city authorities of Paris had decided to abandon the use of tar upon the surface of roads owing to its injurious effects on trees, flowers, and other vegetation on the borders of the roads which had been treated. Our contemporary the "Surveyor" dealt with the matter in an article which appeared towards the close of last month; and this led their Paris Correspondent to have an interview with Dr. Guglielminetti, who resides in the city, to obtain his opinion on the subject. The result of the conversation is given in a letter which appeared in the issue of the paper for the 9th inst.

Asked with respect to the reported cutting down of seven trees on the Avenue du Bois de Boulogne, he said: "I have great pleasure in contradicting these false statements, and in stating that the result of my inquiries is that, fortunately, the whole rumour is unfounded. Not one tree has been cut in the Avenue du Bois de Boulogne on account of the tarring; and the best proof that the City of Paris does not intend to abandon the tarring system is that just ten days ago the Avenue was entirely retarred, and presents a fine appearance. The Chief Engineer of the City of Paris states that, whereas previous to tarring, the construction and maintenance of the avenue cost 2 frs. 10 c. per square metre, this figure has been reduced in the past two years, during which tarring has been employed, to 1 fr. 70 c. per square metre, which includes retarring twice each year. So that there is an actual saving of 40 c. per square metre, which results in a real economy to the city of somewhere about 10,000 frs. (£400) per annum for this single thoroughfare. This resulting economy of wear and tear is the best proof of the actual diminution of dust, seeing that dust means the wearing away and disappearance of the road itself. . . . With regard to the extraordinary rumour that seven magnificent trees in the avenue have had to be cut down owing to the tarring of the road, I am in a position to inform you, after having made inquiries from the Service of Administration of Parks in Paris, that they do not believe that the tarring of the roads is the determinating cause of the death of one single tree. Again, the Boulevard Maillot has been tarred annually for the past five years without a single tree having suffered or having been cut down on account of the tarring."

Dealing with the effect of tarring on flowers, Dr. Guglielminetti said: "I learn, from information which I have gathered at the Service of Administration of Parks, that this is a different matter, and that the tarring of the roads certainly exercises some detrimental influence upon some species of flowers. If it is during the actual operation of tarring that the vegetation in the neighbourhood suffers from the emanations or evaporations thrown off by the tar during the heating of it, one will only have to take the precaution of using distilled tar, and heating it in the workshops or manufactory, far removed from the plants. Or else, one will simply have to plant the flowers after the operation of tarring the road, or sufficiently in advance of the operation, in order that the flowers may have ample time to develop and grow strong before the tarring commences. Whatever may be decided in this respect, tarring presents such actual advantages that it will be necessary to find a method of arranging these subordinate difficulties."

Reference has already been made in the "JOURNAL" to the International Road Congress in Paris. It was opened on Monday last week in the Jeu de Paume, in the Tuileries Gardens. The delegates, of whom there are a good many, were received at the Sorbonne by M. Barthon, the Minister of Public Works, who declared the congress open, and expressed the hope that they would be successful in helping to solve the problems to be discussed. Later in the day, he opened an exhibition of road-making and other appliances in the grounds adjoining the congress hall. One of the most valuable papers contributed during the week was by Mr. Rees Jeffreys, the Hon. Secretary of the Roads Improvement Association, who presented a comparison of the methods and cost of road maintenance in the principal European countries and in India. Another important paper was read by Dr. Guglielminetti, whose views on road-tarring, which are the result of many years' observation, were approved by the majority of the delegates. Telegraphing on Friday night, the Paris Correspondent of the "Daily Telegraph" said that up to then road-tarring had scored a victory in the congress. There was one question which all the members would like to have seen solved, and that was the dust problem. Provisionally, for the want of something better, tar, as already stated, has secured a majority in its favour.

UNPROFITABLE ELECTRICITY SUPPLY.

At a Meeting of the Loughborough Town Council recently, some considerable discussion took place on the accounts of the electricity undertaking for the year ended the 31st of March last. The balance-sheet had been referred to a Special Sub-Committee for investigation, owing to the extraordinary adverse balance on the undertaking. Alderman Bumpus said they were aware that exceptional expenses had been incurred, but the balance on the wrong side was much heavier than had been anticipated. The Committee had gone into the matter as thoroughly as they could, and after making allowance for the exceptional expenses and repairs to plant, which seemed to have accumulated in a remarkable manner, they were obliged to notice that the cost of working expenses was unsatisfactory. The undertaking had been running just over three years, and had made good progress in the matter of demand for light and power; but the Corporation had not made the financial progress they hoped to realize. The adverse balance on the year amounted to £2527, which was some £1500 more than was allowed for in the estimates. The revenue account showed a loss of £314; the sinking fund absorbed £577; interest on loans, £1385; and renewals, £250. During the three years the adverse balance on the working expenses amounted to £190; the charges for sinking fund and interest, which had been heavy, having been taken out of the rates. It was time the position was improved; and unless they were producing satisfactorily it was useless to extend the business. Mr. J. Cartwright commented on the heavy loss which had been incurred, and the great increase that would be necessary in the rates to meet it. He said the Corporation had gone six months further, and it would be serious if they were still losing £50 a week. Mr. Clemerson said he did not see how they could make things better by selling electricity for power at 1d. per unit, when it cost nearly 2¼d. to produce. Mr. Toone drew attention to the wastage—£750, or equal to 49,000 units—and to the fact that in two years the working expenses of the undertaking had practically doubled, though nearly the same amount of electricity was generated. Alderman Bumpus, in reply, said he understood the loss during the past six months was not so heavy, and he had great faith that they would have a much better result in the near future. The report, which authorized the engagement of an expert practical engineer, was confirmed.

A special meeting of the Redditch District Council was held last Tuesday for the consideration of the ensuing half-year's estimates. The total expenditure for the period mentioned was put down at £4788, and the receipts at £754; leaving £4034, for which a general district rate of 1s. 9d. in the pound was necessary. The Chairman of the Electricity Supply Committee (Mr. Dolphin) expressed the regret of the Committee at having to increase the amount necessary for the support of the electricity supply undertaking; but the loss of several large consumers of current and the increased cost of fuel had produced the bad results of the past financial year. Mr. G. F. Brough thought that the undertaking should have turned the corner by now, and ought not to be so heavy a charge upon the rates. Mr. H. Surman expressed the opinion that the town would never get satisfactory results from the undertaking until it was put upon a proper business basis. He deprecated the sale of current for power purposes at rates below the cost of production. Other members criticized the management of the undertaking on the same lines. The estimates were adopted, and a general district rate of 1s. 9d. in the pound decided upon.

CHARGE FOR WATER IN THE CITY OF LONDON.

An Explanation by the Water Board.

Readers may remember that, in compliance with an influentially signed petition, a public meeting has been called by the Lord Mayor to consider the high charges now being made by the Metropolitan Water Board for water supplied in the City, which have given rise to a great deal of agitation. In view of this meeting, we learn that an official statement is to be made by the Board when they assemble next Friday, and that the facts they will submit will help to concentrate the discussion in a practical direction. According to a communication made to the "Evening Standard," the Board contend that it has not been sufficiently realized, in the criticisms and protests which have been made, that Parliament has laid down by Statute the policy which the Board are carrying out. The Board were compelled by the Metropolis Water Act of 1902 to introduce a Bill for a uniform rate throughout the whole of their area. They were allowed no discretion in the matter. Section 15 (6) is as follows:—

> The Water Board shall not, until Parliament otherwise determine, reduce the rates charged for the supply of water below those in force during the quarter ending the 24th day of June, 1902, unless the Board are satisfied that such a reduction would not cause a deficiency in the water fund; but the Water Board shall, within three years after the appointed day [June 24, 1904], introduce into Parliament a Bill providing for uniform scales of charges applicable throughout the limits of supply.

In fixing the "uniform scale of charges," the Board had of necessity to arrange for an income adequate to meet the expenses of the undertaking and to pay interest on the capital of £47,000,000 paid to the Water Companies. The charge they levied—5 per cent. on the rateable value—produces the required amount, and nothing more.

One of the proposals put forward in the City is that the Board should allow large rebates in the case of highly-rated properties. This suggestion was, as a matter of fact, discussed before the Joint Committee on the Board's Charges Bill, and Parliament expressly refused them power (with certain trifling exceptions) to discriminate. An amending Bill might be introduced into Parliament to give the Board discretion in the matter; but if it passed, it would, while removing one difficulty, create another. Rebates to any considerable extent on highly-rated properties would result in a diminished income; and the deficiency could only be met by the levying of a rate-in-aid. Under the new incidence, 80 per cent. of the old charges have been reduced, while only 20 per cent. have been increased.

CARDIFF-MERTHYR JOINT WATER SCHEME.

Partnership not Entertained by Cardiff.

The Water Committee of the Cardiff Corporation recently had a meeting to discuss the proposal to go into partnership with Merthyr in the construction of the suggested Pontsticill water reservoir in the Taff Fechan Valley (*ante*, p. 68). A Sub-Committee of the Merthyr Water Committee had met a Sub-Committee of the Cardiff Water Committee in regard to the matter; and the Water Engineer (Mr. C. H. Priestley) reported in reference to this that the Mayor of Merthyr considered that it would be to the mutual advantage of both towns if Cardiff would take a supply of water in bulk, but that if not a partnership of equal rights and responsibilities in the undertaking could be arranged. Mr. Simons, the Chairman of the Merthyr Water Committee, said the basis of partnership might be arrived at on the total cost of the proposed reservoir, together with the existing reservoir at Pentwyn; each body to take water for its own use at cost price per 1000 gallons, and the surplus to be pooled and sold to various customers—the profits to be divided or the deficit to be shared equally. It was suggested that in the partnership, Merthyr should be allowed a preferential claim to a certain quantity of water on account of their upper gathering-ground partly feeding the new reservoir. Mr. Lewis contended that the cost ought to be borne in proportion to the rateable value of the boroughs, as, the interest, being payable during construction, would entail a heavier rate in Merthyr than in Cardiff. A suggestion was made that, in order to avoid this difference, Cardiff should provide the first £100,000 for constructing the proposed reservoir.

After the departure of the Merthyr Sub-Committee, an approximate estimate of the cost of the scheme was made, as follows:—

Reservoir, dam, and other works, including land	£228,000
Main from Pontsticill to Cardiff	145,000
Main to Wenvoe	25,000
Filters	50,000
Probable allowance to Merthyr in respect of the Pentwyn reservoir	60,000
Cost of promoting Bill	10,000
Total	£518,000

There would be payable an additional £60,000 for interest during construction—thus making the cost £578,000 before any water was received. Interest and sinking fund on this would be £31,790; and adding to this the item of maintenance, £750 per annum, made the cost of the water 2·14d. per 1000 gallons.

According to the Engineer's calculations, there would probably be an estimated quantity of barely 10 million gallons of water per day available. Mr. Priestley believed the amount put down as the cost of the main from Pontsticill to Cardiff was insufficient; and he pointed out that the cost of the whole scheme could not be accurately estimated until the reservoir site was more thoroughly examined, especially as to the foundations. The total cost, even taken at 2½d. per 1000 gallons of water, would not be excessive. There was no doubt that the water from this gathering-ground was good for all purposes; but at the same time he did not consider it would be equal in quality to that at present supplied from the upper reservoirs of the Cardiff Corporation at Taff Fawr, or the upper reservoirs of Merthyr in the Taff Fechan Valley—the land upon the drainage area being much more cultivated, and more farms and buildings being situated thereon. The greatest difficulty was likely to arise with regard to the surplus water.

Mr. Priestley submitted several conclusions which were discussed *seriatim*. The first of them was: "That water impounded in the proposed Pontsticill reservoir cannot be equal in quality to that in the Beacons or the Cantreff reservoirs, having regard to the number of farms, &c., on the drainage area." After some discussion, this was agreed to, as was also a second conclusion to the effect that the estimates for the works might be exceeded to a large extent. The third conclusion set forth that if a working agreement was arrived at, there would be a large quantity of surplus water for disposal at a low price for trade purposes; but if much of this water was sold to present consumers at a reduction, there would for some time be a corresponding loss in revenue and a consequent use of the rate-in-aid. The fourth conclusion, which was adopted, stated that there were many difficulties in arriving at a fair basis of arrangement between the two Corporations. The fifth ran: "That only on the basis of Cardiff having an absolute right to a moiety of the water, having paid a moiety of the cost, is the scheme to be recommended; and that each town should find its own customers on its own terms." It was decided to strike out the latter portion of the sentence. The sixth conclusion stated that the construction of the Llwynon reservoir would involve an expenditure equal to a rate of 2·8d. in the pound; whereas the charges for the Pontsticill reservoir would be equivalent to a rate of at least 4d., and possibly more. This was agreed to, as was also the final conclusion, that Cardiff, having its own reservoir, would have absolute control of the works, and could regulate its storage and supply accordingly; while in the case of a Joint Board any dispute would be subject to arbitration, perhaps of a costly character.

The Committee decided to report to the Council that, having regard to the greater anticipated cost of the Pontsticill scheme as compared with the Llwynon scheme, and the better quality of the water of the Beacons and Cantreff, the difficulties of dual control, Merthyr's request for preferential treatment and refusal to include in the scheme the pooling of its upper waters, the Committee felt strongly the undesirability of further considering the suggested partnership.

Sale of Shares.—Messrs. Sadler and Baker last Thursday sold by auction at Yorktown 600 additional ordinary £10 shares in the Frimley and Farnborough District Water Company. The shares were offered in sixty lots of ten shares each; and all were quickly disposed of at increased prices. The sale realized £9068 15s.—an average of £15 2s. 3d. per share.

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NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Town Council of Kirkcaldy had a field night on Monday over the question of the burgh gas supply. In accordance with notice given, Mr. Wright moved—"That a Committee be appointed to consider and report on the advisability of the Council taking up the question of supplying the community with gas light, as the present supply is insufficient in quantity and inferior in quality; the present Gaslight Company having failed to keep up to the needs of the community." He said the general opinion throughout the town was that the gas was very inferior. In fact, it seemed to him that unless the Gas Company had latterly adopted the new plan of employing a "pump brigade" to go round the town with a force-pump, to clear away the rubbish accumulated in the pipes, the town would have been left in darkness. On several occasions they would have been minus their local newspapers had this method not been employed. Most of the Council he was sure would agree that the gas was bad. It seemed to him that while consumers had been spending a good deal of money in adopting the newest styles of mantles and burners, the Gas Company, instead of trying to make things better, had been taking advantage of this to see how cheap they could make the gas. The Company had been making very bad and very cheap gas; and while doing so they had been realizing large profits. The capital of the Company was £65,330; and out of this the gas consumers of Kirkcaldy had contributed some £26,000. They had to pay 7½ per cent. on the capital of the Company. Then the Company made huge sums and gathered them up for future distribution; and when they distributed these sums, they had likewise to pay 7½ per cent. on that capital. It was monstrous that the Council should allow this to go on much longer. Twelve years ago the Dunfermline gas undertaking was taken over by the Corporation; the rate then being 3s. 7d. per 1000 cubic feet. To-day it was down to 2s. 6d.; while they had managed to pay back £24,000 of the share capital during that period. In Kirkcaldy they were going on paying 3s. 4d. per 1000 cubic feet, and allowing the Company to amass sinking and redemption funds. The approximate charge for municipal undertakings was 2s. 5d. per 1000 cubic feet; while for company undertakings, the average was 2s. 10½d. He held that it would be for the benefit of the town if the question were tackled at once. Mr. Thom, in seconding, said he did so on the ground that it was a very well-known fact that in recent years there had been such improved methods of producing gas—he did not say that the gas had improved—that it could now be manufactured at a much lower cost than hitherto. With all these improvements the gas had not been better; and he considered it right that a Committee should be appointed to look into the whole question. Treasurer Kilgour said that more than thirty years ago the Town Council, in approaching Parliament for the extension of the burgh, put into their Bill a good many clauses concerning the gas undertaking, and evidently it was then thought that the time had come when some action should be taken. It was unfortunate for Kirkcaldy that it was not undertaken at that time. Twelve years ago, when the concern was smaller than it was now, a very elaborate report was prepared by the Town Clerk, who, although Secretary and Treasurer to the Gas Company, very fairly put before the Town Council the facts of the case. Unfortunately, the Council at that time refused to take over the undertaking. The bogey of the electric light staggered them; and now he would not be a party to villainize the Gas Company. The Company had undertaken all the risks; and they were entitled to reap the benefits. He had long had it in his mind to make a motion that they should buy up the undertaking; but for several years they had been promoting very large undertakings, involving considerable sums of money. This work was not yet out of their hands; but he was prepared to move that it be remitted to the Finance Committee to consider whether it would be expedient for the Council to buy up the gas undertaking, and to report. If they decided to buy up the gas undertaking, the question of price must go to arbitration; and they must accept the price of the arbiter. The amount was likely to be a good deal over £100,000. The Council, by twenty votes to four, adopted Mr. Wright's motion, and appointed a Committee.

On two occasions recently I have chronicled the doings of H.M.S. *Rattler* as a gas-driven naval ship. I am now able to give some particulars regarding the vessel, which I have procured from an article that was published in the "Scotsman" on Tuesday of last week. Twenty-five years ago the vessel was added to the Navy as a steam auxiliary. After serving her day, she was placed on the list to be broken up. But the Marquis of Graham, Commander of the Clyde Division of the Royal Naval Volunteers, sought and obtained the use of her as a training ship. Then Messrs. Wm. Beardmore and Co., Limited, joined with the Marquis in the experiment of fitting the vessel with the first marine gas-engine. Like many another experiment, the new engine was not an immediate success. But difficulties were overcome, and in this, her second, season, the *Rattler* has "gassed" for close on 2000 miles without a single hitch. It is claimed that she is the only sea-going vessel in the world driven by gas power. In his description of the vessel, the writer states that the stokehold provided the first surprise. In one corner stood a donkey boiler, which supplies all the steam necessary for working the auxiliary machinery of the ship, and also for purifying the gas. The centre of the stokehold is taken up by a tank-like structure. This is the gas-producer. In place of a small army of grimy firemen feeding blazing furnaces—the usual sight in a warship's stokehold—a lad comprised the entire watch. Anthracite coal is used. The producer requires from 180 lbs. to 200 lbs. per hour. The coal is passed into a hopper, which feeds the producer from the top, and the gas goes through a scrubber and dryer before passing into the engine. A new style of producer has come into vogue since the *Rattler's* installation; and with this it is expected that it will be possible to substitute for anthracite the cheapest of coal refuse, and thereby to very materially minimize the present small cost. The engine is known as Beardmore's "Capitan" ga -engine. It is much lower set than the usual reciprocating engine, and the swish

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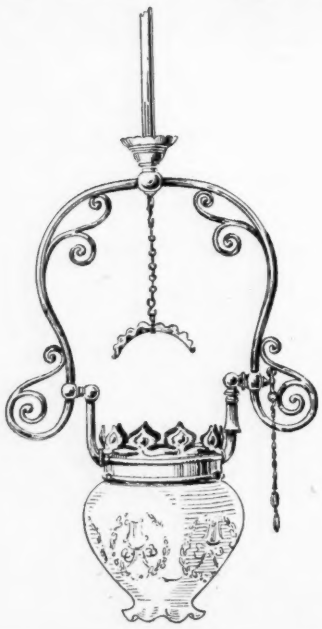

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DEVONPORT.

of the steam-driven machinery gives place to a monotonous "chunk" at each explosion; the noise, however, being less pronounced than in the ordinary engine-room on board ship. Of vibration there is practically none. There are five cylinders, working a like number of cranks, with a 2-feet stroke; and in the event of anything happening to put a cylinder out of gear, the engine can still be kept going with the others. To start the machinery, an explosive mixture of air and gas at a pressure of 100 lbs. is used. The engine works with five explosions, on the auto-cycle principle. With the 20-inch piston coming down, the gas is sucked in from the producer; on the back stroke, the gas is compressed; the next outward stroke brings the explosion; and the exhaust is effected at the last stroke. The saving of coal is estimated at 50 per cent., as compared with a steam-engine. Experience has shown that by one filling of the producer the engine can be kept running for twenty hours. When in the Mersey, a party of marine engineers and other experts were given a run on the vessel. In addressing them, the Marquis of Graham said he thought when the idea of gas propulsion was more fully developed, and they had had more experience with it, there must be a great future for it; and nobody would be more grateful than the seamen. It had been well said that if the stokehold on board ship could be abolished, it would be an act of mercy; and he was of opinion that they had gone a long way towards achieving this end.

Complaints have been frequent of late regarding the inadequacy of the water supply in the higher portions of the area of supply of the Glasgow Corporation; and as the outcome of a remit to him on the subject, the Water Engineer—Mr. J. R. Sutherland, C.E.—has prepared a report, which came before the Town Council on Thursday. One of the districts affected is Springburn. Regarding it Mr. Sutherland stated that the population now being supplied with pumped water is 25,000, and the extended area to which it is proposed to improve the supply contains a population of about 44,000. It is only necessary to supply pumped water to flats which stand above the reach of the gravitation supply. If this system were adopted, the number of persons to be served with pumped water, in addition to the 25,000, would be about 17,000. It would be necessary to increase the engine and boiler power at the Springburn pumping-station, and to lay duplicate distributing pipes. The alteration on the pumping-station would make it capable of pumping three million gallons instead of one million gallons daily, with one engine in reserve. This would provide a supply greatly in excess of immediate requirements. The upper flats of the tenements on Gilshochill are so near the top water level of the reservoirs that a new pumping-station for that district would be an advantage, and would give a more extended use to the trunk main which supplies it. The duplication of the trunk main from the Gorbals works provides a high-level main, from which, if its use were carefully restricted to the service of high-level districts, sufficient pressure could be obtained to supply the top flats of houses in the south side without pumping. Two other mains from the Craigmaddie reservoir should be laid—one to the east and the other to the west, diverging at Possil Park. In connection with the laying of these mains, it would be necessary to obtain powers, as the work would involve interference in several places with railways and canals, and possibly with private property. He estimated the cost of these works at £285,250. The Water Committee recommended that Mr. Sutherland's proposals be generally approved. As the borrowing powers of the Corporation under the Water Acts are sufficient to meet the greater part of the estimated cost of the proposed works, it is unnecessary to make any application to Parliament in the ensuing session for increased borrowing powers. With regard to the proposal to lay duplicate distributing pipes (one for gravitation water and the other for pumped water) in certain streets in Springburn, the Committee recommended that the Town Clerk be instructed to report whether or not it would be necessary to obtain parliamentary powers to compel owners of properties which can be adequately served only by taking a supply of pumped water for certain flats, to fit up in such properties the requisite additional service-pipes from the public main distributing pumped water. The report and recommendations were approved by a large majority of the Council. In submitting them, Mr. Edward Watson said that, taken in connection with the Loch Arklet scheme, the total expenditure within the next few years would be something like £400,000. Towards meeting this sum he pointed out that the department were spending on the relining of the old aqueduct from Loch Katrine about £15,000 per annum, and on the relaying of mains from the Gorbals works about £5000 per annum—a total payment of £20,000, of which they would be relieved during the next twelve months—while the sinking fund and interest on the proposed outlay would not amount to more than this. Had the new scheme not been necessary, they would have been able to reduce the water-rate both within and without the city at a very early date.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 17.

Sulphate of Ammonia.

The market has been very steady during the week; the demand having been well sustained, and parcels offered have found purchasers at previously reported prices. At the close there is some slight improvement in values, and quotations now are £11 5s. f.o.b. Hull, £11 6s. 3d. f.o.b. Liverpool, and £11 8s. 9d. to £11 10s. f.o.b. Leith. In forward delivery, makers' views are still £11 17s. 6d. for January-June, but so far no sales seem to have taken place. For November-December, there would be buyers at £11 8s. 9d. to £11 10s.

Nitrate of Soda.

This article remains unchanged at 9s. 6d. for ordinary and 9s. 9d. for refined qualities.

LONDON, *Oct.* 19.

Tar Products.

The markets have been steady throughout the past week. Pitch is very firm. Manufacturers are not at all inclined to sell, and are

"BLAND" again successful.

The Jurors at the FRANCO-BRITISH EXHIBITION have awarded a

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TO THE

'BLAND' BURNER

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fully convinced that by waiting they will secure better prices. There is a decidedly improved demand from the Continent; while in South Wales there is also some inquiry. Creosote is firm, and good prices are being paid all round. Benzol, 90 per cent., is weak, and low figures are reported to have been accepted on the Continent for English makes. Benzol, 50-90 per cent., is difficult of sale; and here again low prices have been accepted on the Continent. Toluol is fairly firm, and good prices are stated to have been offered for delivery all over next year. Solvent naphtha is steady without any improvement in price. Heavy naphtha is in fairly good demand for delivery all over next year; but buyers will not offer much at even to-day's prompt figures. Carbolic acid is weak, and business has been done on the east coast at 1s. 1½d. for prompt delivery. Liquid carbolic is steady; but crystals are very quiet, and are selling at prices which must leave the manufacturers a loss.

The average values during the week were: Tar, 12s. 9d. to 16s. 9d. *ex* works. Pitch, London, 23s. to 23s. 6d.; east coast, 22s. 6d. to 23s. 6d.; west coast, 22s. 6d. to 23s. 6d. f.a.s. Benzol, 90 per cent., casks included, London, 7d. to 7¼d.; North, 6¾d. to 6⅞d.; 50-90 per cent., casks included, London, 7¼d. to 7⅜d.; North, 6⅞d. to 7d. Toluol, casks included, London, 8¼d. to 8⅜d.; North, 8⅛d. to 8¼d. Crude naphtha, in bulk, London, 3¼d. to 3⅜d.; North, 3d. to 3⅛d.; solvent naphtha, casks included, London, 10¼d.; North, 9¾d.; heavy naphtha, casks included, London, 10¼d. to 10⅜d.; North, 9¼d. to 9⅜d. Creosote, in bulk, London, 2⅜d. to 2⅝d.; North, 2⅜d. to 2⅝d. Heavy oils, in bulk, 3d. to 3 1/16d. Carbolic acid, 60 per cent., casks included, east coast, 1s. 1½d. to 1s. 2d.; west coast, 1s. 1d. to 1s. 1½d. Naphthalene, £3 10s. to £7; salts, 35s., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

This article has been steady throughout the past week. In London, the Gas Companies maintain their prices for delivery to the end of the year; while outside makes upon Beckton terms have hardened to £11 7s. 6d. In Hull, £11 5s. can be secured for ordinary makes, and £11 6s. 3d. for the best. In Liverpool, £11 7s. 6d. to £11 8s. 9d. is quoted; while in Leith nothing under £11 10s. can be considered.

The Local Government Board and the Cost of Tarring Roads.—The West Riding County Council recently agreed to bear two-thirds of the cost of tar-spraying certain main roads, provided one-third was borne by the local authorities in whose districts the roads so treated were situated. One of the District Councils coming within the agreement was the Settle Rural Council, and the payment by them of the one-third cost has been surcharged by the Local Government Board, on the ground that tar-spraying does not amount to an "improvement" within the statutory provisions in that behalf. The Council have appealed against this decision.

COAL TRADE REPORTS.

Northern Coal Trade.

There is a quieter tone in the coal trade, which is shown most in the steam fuel branch. Best Northumbrian steams are about 12s. 6d. per ton f.o.b. For second-class steams, the quotation is from 10s. 9d. to 11s. 6d. per ton, and for steam smalls from 5s. to 6s. Work is fairly good at some of the collieries; but the falling off of the Baltic demand is shown by a little short time at others. In the gas coal trade the demand improves, both for home use and export, but especially for the former. There is a heavier shipment to some of the Italian ports; and it is evident that there have been more contracts entered into for some of these ports—delayed in certain cases by the congestion at Italian ports, but now being more freely shipped. Durham gas coals are now quoted from about 9s. 9d. to 11s. per ton f.o.b. for the usual classes, according to quality, and with about 11s. 9d. quoted for "Wear specials." The local consumption of gas coals is now more full at the engineering works, where many gas-engines are employed. Coke is steady, and gas coke is firm. The current prices for good gas coke are from 17s. 3d. to 18s. 3d. per ton f.o.b.; but the production is steadily increasing.

Scotch Coal Trade.

The market remains unchanged. There is a good foreign demand; and the home request is steady for all but the smaller sorts. Prices remain unaffected, and are quoted at: Ell, 10s. 6d. to 12s. per ton f.o.b. Glasgow; splint, 11s. 3d. to 11s. 6d.; steam, 10s. 3d. to 10s. 6d. The shipments for the week amounted to 318,528 tons—a decrease of 34,059 tons upon the previous week, but an increase of 7998 tons upon the same week of last year. For the year to date, the total shipments have been 11,325,742 tons—a decrease upon the corresponding period of 260,712 tons.

The New Water-Works at Gosport.—The shareholders of the Gosport Water-Works Company have been much gratified by the opportunity recently afforded them by the Directors of making an inspection of the new works at Shedfield and Soberton, which have been completed well within the estimate of £50,000 given by the Engineer (Mr. E. T. Hildred). The Company's Act of 1904 stipulated that the work was to be completed within three years; and it was actually carried out in little more than two. The consequence has been that the old wells at Bury and Foxbury have been disused, though the former has been reserved as an auxiliary. An area of 4 acres at Shedfield has been utilized for a reservoir, which is 200 feet long, 125 feet wide, and 14 feet deep; its capacity being 2,100,000 gallons. The total storage of water is equal to 2½ days' supply. The Chairman (Mr. E. T. Churcher) and others spoke highly of the successful labours of the Engineer; and Mr. Hildred, in an appropriate response, returned the compliments paid to him.

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FIRST IN 1889.

THE INTRODUCTION OF THE SLOT METER.

WRITING to supplement the information given in our "Questions and Answers" column last week with regard to the introduction of the slot meter, a correspondent says that the first patentee was Mr. W. Brownhill, but his meter was never in practical use. The first Gas Company to supply gas in quantity through slot meters was the Liverpool United Gas Company. They supplied gas in bulk to the Corporation for the artisans' dwellings in Casino Street, Liverpool. The Corporation fixed 50 penny-in-the-slot meters in these dwellings. The meters were Thorp and Marsh's patent, and they were manufactured by Messrs. Sawer and Purves. The meters were fixed for six months on approval, at the end of which time the Corporation had to decide whether they were a success or failure. Mr. Marsh entered into a guarantee that the meters should be satisfactory, and he undertook liability for any accident that might occur. Our correspondent adds that he has no hesitation in saying that Sir George Livesey was the first man controlling a gas undertaking to strenuously advocate the use of the slot meter.

GAS v. ELECTRICITY

(From the GAS WORLD.)

FOREMOST 1908.

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MILES PLATTING, RADFORD ROAD,

MANCHESTER, GLASGOW, NOTTINGHAM.

Public Lighting Question at Westhoughton.

A debate on a controversy which has arisen between the Westhoughton District Council and the Gas Company occupied a considerable amount of time at the meeting of the Council on Monday last week. At a special meeting of the General Purposes Committee held on the 10th ult., it was proposed that the Gas Company be requested to supply to the Council 3 and 4½ cubic feet of gas per hour to such public lamps as were required. To this an amendment was moved that the Council obtain their supply of gas for the public lamps by meter; but it was lost, as was another to the effect that a small Sub-Committee should be appointed to meet the Directors of the Gas Company to confer as to the differences with the Council, in order to ascertain what arrangements would be most agreeable to both bodies. It was finally resolved, however, that a Sub-Committee should be appointed to interview the Gas Company if necessary. This resolution came up on the minutes of the General Purposes Committee. In addition, there was on the *agenda* a notice of motion by Mr. J. H. Taylor "That the resolution of the Council passed on July 30, 1908 (rescinding a previous resolution passed on March 2), be now rescinded, and that the resolution of the Council passed on March 2, agreeing to fix 12 meters for measuring the gas supplied to this Council, become operative and in full force; and that the meter lamps and meters now lying in the store-yard be fixed in positions to be arranged and connected with the Westhoughton Gas Company's mains, in order to measure the gas consumed by the street lamps." After a long discussion, Mr. Taylor's motion was put, and the voting upon it was equal. Thereupon the Chairman (Mr. A. Hamer) stated that, as he had voted on the matter before, he would not give his casting vote. The minutes of the Committee were then put, and six councillors voted for and six against their adoption. This time the Chairman gave his casting vote on the side of the former; and the minutes were passed—Mr. Taylor's motion being thereby negatived.

The Proposed Purchase of the Stourbridge Water-Works.—Last Tuesday week, a deputation attended a meeting of the Bromsgrove District Council, on behalf of the ratepayers of the parishes of Pedmore, Hagley, and Clent, and urged the Council to withdraw from the scheme for the purchase of the Stourbridge water undertaking. The objection of the deputation was that these places were being made participants in a scheme which would be of no advantage to them, and must, of necessity, for some time, be a burden upon the ratepayers. Figures proved that from the commencement they would have to contribute an additional rate of 2d. in the pound. Moreover, the districts were mainly agricultural, and the land, as well as the house property, would have to bear the burden. Many of the houses were also beyond the possible limits of supply. After the deputation had withdrawn, notice was given by a member of the Council that he would move the rescinding of all resolutions which had been passed on the subject, with the view of having the purchase question re-opened.

Lead Poisoning at Dewsbury.

A long inquiry has just been concluded at Dewsbury into the circumstances attending the death of Martha Maria Waite, a young married woman, which occurred in Dewsbury Infirmary early in August. Medical evidence showed that deceased had contracted lead poisoning; and the Jury returned a verdict that it had been caused by drinking water from the tap attached to a lead pipe. The water in question is very soft, and consequently liable to take up lead; and the Jury added to their verdict, which was one of "Death from misadventure," a strong recommendation that samples of the water should be more frequently sent for analysis. It was suggested by the Coroner (Mr. P. P. Maitland) that the water should be subjected to some slight hardening process, which would render it safe for consumption, and at the same time would not be detrimental to it from a trade point of view. The Town Clerk (Mr. H. Ellis), who is also Clerk to the Dewsbury and Heckmondwike Water Board, said he would convey the verdict to the Water Committee of the Corporation and also to the Board. He pointed out that in 1905 the Analyst reported that the water had no action on lead; and he was astonished to learn that there were now several cases of lead poisoning in the Infirmary. The Water Committee had not had any complaints, except in isolated cases; but the matter was one to which they would have to give their attention. With regard to the hardening process, the Corporation had always been assured that their water was one of the purest in the country; and they had ever been loth to vitiate it by mixing with it any chemical substance.

Defective Public Lighting at Petersfield.—The Petersfield Urban District Council have received a report from a specially appointed inspector that between the 13th of August and the 29th of September 330 of the public lamps were found inefficiently lighted; and as 72 of them were subsequently found in this condition, the Council have directed that £3 12s. shall be deducted from the quarterly account of the Company. The explanation given is that owing to a failure of the retorts, gas was produced of less than the usual illuminating power.

New Joint-Stock Companies.—The Cordoba Light, Power, and Traction Company, Limited, has been registered with a capital of £500,000, in £1 shares, to acquire the benefit of concessions, grants, decrees, rights, and powers conferred by any authority in Cordoba or elsewhere in the Argentine Republic, &c. The Perfect Mantle Company, Limited, has been registered with a capital of £2000, in £1 shares, to acquire the business of incandescent mantle and general gas-fittings merchants carried on by Mr. H. Ogus at 9, Whitechapel Road, E., as the Perfect Mantle Company. Mr. Ogus is the first Managing Director, and he may retain office for life. The Newton-on-Ayr Gas Company, to take over the works and carry on the business of the Ayr and Newton Consumers' Gas Company, has been registered in Edinburgh with a capital of £55,000, in £1 shares, divided into 15,000 4 per cent. non-cumulative preference and 40,000 ordinary.

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Cost of Public Lighting at Barnstaple.

At last week's meeting of the Barnstaple Town Council, attention was again called to the excessive cost of the public lighting. Mr. White, who brought the matter forward, moved that the charge for electricity should be reduced to the rate paid by other large users of current for lighting purposes. His complaint was that, while private consumers were paying as low as 2¾d. per unit, the Corporation were being charged 5d. per unit, with the result that the cost of public lighting amounted to £2400 per annum, which was equal to a rate of 1s. in the pound. When the streets were lighted by gas, the cost was £760; and they had now 153 gas-lamps, which cost £303 per annum, or £2 per lamp—a figure which might be reduced by 10 per cent. by adopting the incandescent system—while their 200 electric lamps cost £2136, or £10 3s. per lamp per annum. Mr. Barrett, the Chairman of the Electricity Committee, admitted that the charge for current was higher than in many other towns; but he explained that places which charged as low as 2d. per unit had tramways, and consequently a large output of electricity for power purposes. They had reduced the price for public lighting by 10 per cent., bringing it down to 4½d. Mr. Pearce said the difficulty was that the undertaking was over-capitalized, and they could not sell current for 2¾d. per unit if it cost 5½d. to produce. Mr. White contended that if a profit could be made out of private consumers at 2¾d. per unit, the public ought not to be charged so much. Since electricity was adopted, they had paid £5600 more for public lighting than they would have paid if they had continued to use gas. The motion for reducing the charge was defeated.

Gas-Workers' Conditions at Oldham.

In view of statements that had been made in various quarters, Mr. Tim Duxbury, the Gas Engineer, was asked at the last meeting of the Oldham Gas Committee to state the actual number of hours worked by the retort-men, and the possibility of their working fewer hours and so giving employment to more men. Mr. Duxbury said the men were on the premises on the average in seven-hour shifts seven days per week. Of this seven hours, they actually worked four hours; for during the interval between the "draws" they could do as they liked. If they put in an extra shift one week, they had a shift less the next. Not one worked 60 hours per week. The Committee at the last meeting had agreed to increase the wages from 5s. 3d. to 5s. 4d. per shift. The custom was to count them eight-hour shifts; but the stokers went off, taking the year round, after seven hours. The foremen were left to see that all went well; there was no need for the retort-men to stay. The Committee increased the wages of the foremen to 6s. per shift. Pressed on the question of finding work for more men, Mr. Duxbury said that he was now experimenting at the central station upon the practicability of abolishing Sunday labour there. This would mean a falling off in the make of gas that day, which would have to be made during the week, and so would give work for perhaps seven or eight more men. Until they got the proposed new holder, he could not dispense with Sunday work at the other stations. In time, and if the experiment showed that the thing could be worked, they would be able to do without Sunday labour and give employment to some thirty extra men. They would in that case save the difference between the time-and-a-half paid for Sunday labour and the wages paid to the extra men. The Committee expressed approval of the idea; and Mr. Duxbury was asked to carry it out as far as is possible under existing conditions.

Opposition to the Port of London Bill.

At the meeting of the Thames Conservancy on Monday last week, the Parliamentary Committee reported that they had called a conference of petitioners against the Port of London Bill, and that it was attended by 59 representatives of 31 bodies, including the Corporations of London and West Ham, the County Councils of Berks, Essex, Fulham, Hammersmith, Kent, Middlesex, and Richmond, the Metropolitan Water Board, the Gaslight and Coke, Wandsworth and Putney, and South Suburban Gas Companies, and the London Waterside Manufacturers' Association. The following resolutions were unanimously adopted: "That this conference of representatives of industrial, trading, and carrying associations and public bodies interested in the Port of London, specially convened to consider the Port of London Bill as amended in Committee, hereby records its conviction that the provisions of the Bill, more especially those providing for the transfer of the docks to a public authority, and determining the financial basis of the transfer, will, if passed into law, disastrously affect the industrial, trading, and carrying interests of the Port of London." "That, in the opinion of this conference, the inquiry before the Committee of Parliament as to the consideration proposed to be given for the transfer of the dock undertaking is most unsatisfactory; that the Board of Trade have entirely failed to show that the arrangements for the purchase of such undertakings are based on reasonable conditions; and that it is most essential in the interests of the Port of London that the Bill as it stands should not pass into law." It was decided that copies of the foregoing resolutions should be sent to the City Corporation, the London County Council, and other local authorities, with a request that these bodies should oppose the further progress of the Bill, and also to the Government; and, further, that a Committee should be appointed with power to organize meetings, arrange deputations, and use any other legitimate means to prevent the Bill passing.

A Southport Elective Auditor on Gas Profits.—One of the Elective Auditors for Southport has just issued his report on the affairs of the Corporation. Dealing with the subject of the appropriation of gas profits, he says: "Whether large profits should be made and used for the relief of the rates or the gas sold at the barest possible margin is a question upon which there is considerable difference of opinion; but, under conditions at present obtaining, the Gas Committee, in my judgment, are acting wisely in the policy they are pursuing."

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Imperial Continental Gas Association.—Accompanying the notice issued by the Secretary of the Association (Mr. Robert W. Wilson) for the half-yearly meeting on the 3rd prox. is the balance-sheet to the 30th of June. The works and mains (less amortization) and land are put down at a sum of £3,872,911; investments and loans abroad (less depreciation) stand at £1,551,046; investments in English and Indian securities, at £268,417; and other items make up a total of £7,054,879. The capital stock figures at £4,940,000; the debenture stock (3½ per cent.) at £473,600; and the premiums on stocks at £327,345. The Association have a reserve fund consisting of £400,000 of 2½ per cent. Consols. The balance brought forward was £30,811, and the profit for the half year £240,078—together, £270,889. As mentioned in the "JOURNAL" last week, the Directors propose to pay a dividend of 4 per cent. for the half year, free of income-tax.

City of Chichester Gas Workers' Club.—At the opening of the winter session of entertainments last Friday, the Club were honoured by the presence of the Right Worshipful the Mayor of Chichester (Alderman J. O. Holt) and the Mayoress. The Mayor presided during the entertainment, which had been provided under the management of the Company's Engineer, Mr. T. E. Pye. It included a cantata in character, entitled "Cinderella," very prettily rendered by a number of young ladies of the city. Responding to a vote of thanks, the Mayor referred in very eulogistic terms to the "transformation scene" which had taken place at the Chichester Gas-Works, reflected not only in the appearance of the works, but also in the greatly improved condition of the employees. He contrasted the known circumstances of the workmen of past days with their happy condition of to-day, with their recreation-rooms, entertainments, and games, clubs, &c.; the initiation of all these improvements being due to the Engineer, who was sympathetically and practically supported by the Company's Chairman (Mr. Alfred Lass) and his co-Directors. He concluded by calling for cheers for Mr. and Mrs. Pye, which were very heartily given.

Suggested Gas-Works for Preesall.—The Preesall Urban District Council recently received a letter from Mr. A. Hindle, of Blackpool, stating that he had been instructed by some clients to prepare the necessary information to enable them to apply to the Board of Trade for a Provisional Order for the purpose of supplying the urban district area of Preesall with gas. They wished to inform the Council of this, with a view to their co-operation and support. If a Committee of the Council would like to meet his clients and himself on the matter, they would be able to do so. The Surveyor (Mr. Boaz) suggested that a Special Committee be appointed. If the Council had any idea of applying for a Provisional Order, no time was to be lost. Mr. Cardwell observed that at Halton, near Lancaster, they had a small plant of their own, which only took one man to look after; and if it could be made to pay there, it should do so at Preesall. Mr. Hunt said when private companies were allowed to get these Orders, it was very difficult to regain the power. He thought they ought to take steps at once to get a Provisional Order for themselves. The Surveyor pointed out that their attitude was not in antagonism to the Company, for the Council had for some years been going into the matter. A Committee of the whole Council was appointed.

Price of Gas at Matlock Bath.—At the last meeting of the Matlock Bath Urban District Council, Mr. Reeds, in moving the adoption of the report of the Gas Committee, said they had made a profit on the gas-works during the last half year of £607, despite the fact that they had to pay an increased price for coal, and there had been a decrease in the consumption of 607,000 cubic feet. As Chairman of the Gas Committee, he was pleased to be able to announce that they had secured contracts for coal at a more normal price; and he hoped to be able to present a most satisfactory balance-sheet at the end of the year. They had been badgered by the Finance Committee to give a share of their profits towards the relief of the rates. For obvious reasons, they had decided not to do so this half year; but the Committee had promised to give something out of the next half year's profits, on condition that half of the profits went to relieve the rates, and the remaining portion to the reduction in the price of gas. He, however, hoped the Council would adopt the broad principle of letting the town's affairs be financed on its rates, and not from the pockets of the poor gas consumers.

Bankruptcy of a Gas Engineer.—At the Wandsworth County Court last Thursday afternoon, before Mr. Registrar Willoughby, the public examination was held of William Tice, of 15, St. James's Road, Upper Tooting. The summary of accounts filed by the debtor showed gross liabilities expected to rank against the estate for dividend amounting to £500 13s. 6d., and assets *nil*. Replying to Mr. Knight, the Assistant Official Receiver, the debtor stated that in 1895 he commenced business as a gas engineer at Carteret Street, Westminster, under the style of the Automatic Gas-Governor Company, and subsequently as Messrs. W. Tice and Co. In 1903 he entered into partnership with another person, who paid £500 for a half share of the business; but a few months later differences arose between them, and in December, 1904, the concern was taken over by the partner. During 1904 he became interested with another in the exploitation of an automatic gas-meter and a gas-governor. In 1906 a company was formed to work the governor, under the style of Tice's Gas Apparatus Company, Limited, and he was appointed Manager, at a salary of £250 per annum. Subsequently disputes arose between himself and his co-Directors, and he withdrew from the business. He was now in the employ of his wife, who carried on business as the Automatic Gas-Governor Company. His present position was due to law costs and money expended in exploiting patents which proved unremunerative. The examination was adjourned.

By an announcement which has appeared in our advertisement columns, our readers will see that the Directors of the Mitcham and Wimbledon Gas Company are prepared to receive, up to five o'clock next Monday, sealed tenders for £10,000 of consolidated ordinary stock of the Company, in lots of the nominal amount of £50, or multiples thereof, at the minimum price of £105 per £100 of stock.

The authorities at the Royal Palace, Rome, after obtaining fullest particulars from local and foreign houses, have entrusted the Richmond Gas Stove and Meter Company, Limited, with the equipment of gas apparatus for the private kitchen of His Majesty the King of Italy. The Company have only recently completed the erection of gas apparatus in the kitchens of His Holiness the Pope at the Vatican.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 183.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 15	10	Alliance & Dublin 10 p.c.	18¼—19½*	..	5 2 7
268,324	10	,,	7	Do. 7 p.c.	12½—13¾*	..	5 3 8
310,000	Stk.	July 15	4	Do. 4 p.c. Deb.	99—102	..	3 18 5
800,000	5	May 29	6½	Bombay, Ltd.	5¼—6½	..	5 4 0
40,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
50,000	10	Aug. 27	14	Bourne-mouth Gas and Water } 10 p.c. B 7 p.c. Pref. 6 p.c.	28—29	..	4 16 6
51,810	10	,,	7		16¼—16½	..	4 3 7
53,200	10	,,	6		15—16	..	3 15 0
380,000	Stk.	Aug. 13	12½	Brentford Consolidated	244—249	..	5 0 5
300,000	,,	,,	9½	Do. New	183—188	..	5 1 7
50,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
206,250	,,	June 12	4	Do. 4 p.c. Deb.	100—105	..	3 16 2
220,000	Stk.	Sep. 11	10½	Brighton & Hove Orig.	205—210	..	5 2 4
246,320	,,	,,	7½	Do. A. Ord. Stk.	150—155	..	5 0 0
460,000	20	Oct. 15	10	British	41—42*	..	4 15 3
109,000	Stk.	Aug. 27	6	Bromley, Ord. 5 p.c.	113—116	..	5 3 5
165,700	,,	,,	4½	Do. do. 3½ p.c.	84—86	..	5 4 8
500,000	10	Oct. 15	7	Buenos Ayres (New) Ltd	11—11½*	..	6 1 9
850,000	Stk.	June 26	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 15	7½	Cagliari, Ltd.	24½—25½	+½	5 13 9
100,000	10	—	—	Cape Town & Dis., Ltd.	4—6	..	—
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	5—7	..	6 8 7
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	48—50	..	6 0 0
100,000	Stk.	June 26	4½	Do. 4½ p.c. Deb. Stk	78—83	..	5 8 5
157,150	Stk.	Aug. 13	5	Chester 5 p.c. Ord.	108½—110½	..	4 12 7
1,493,280	Stk.	Aug. 27	5⅝	Commercial 4 p.c Stk.	106—111	..	4 13 8
560,000	,,	,,	5	Do. 3½ p.c. do.	103—106	..	4 14 4
475,000	,,	June 26	3	Do. 3 p.c. Deb. Stk.	82—84	..	3 11 5
800,000	Stk.	June 12	6½	Continental Union, Ltd.	108—113	..	5 15 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—142	..	4 18 7
460,170	Stk.	,,	5	Derby Con. Stk.	122—124	..	4 0 8
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
148,995	,,	Sep. 30	5	East Hull 5 p.c. Ord.	97—100	..	5 0 0
486,090	10	July 15	12	European, Ltd.	23½—24½	..	5 0 0
354,060	10	,,	12	Do. £7 10s. paid	17—18	..	5 2 10
15,182,590	Stk.	Aug. 13	4/1c/8	Gas-light and Coke } 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref. 3 p.c. Con. Deb.	97—99	..	4 10 8
2,600,000	,,	,,	3½		87—89	..	3 18 8
3,799,735	,,	,,	4		105—107	..	3 14 9
4,193,975	,,	June 12	3		85—87	..	3 8 11
258,740	Stk.	Sep. 11	4⅝	Hastings & St. L. 3½ p.c	93—95	..	4 16 11
82,500	,,	,,	£1¼	Do. do. 5 p.c.	112—115	..	5 8 8
70,000	10	Oct. 15	11	Hongkong & China, Ltd.	17½—18½*	..	5 18 11
4,940,000	Stk.	May 14	8	Imperial Continental	182—184	..	4 7 0
473,600	Stk.	Aug. 13	3½	Do. 3½ p.c. Deb. Red.	94—96	..	3 12 11
561,000	Stk.	Aug. 27	10	Liverpool United A	227—229	..	4 7 4
718,100	,,	,,	7	Do. B.	166—168	..	4 3 4
306,083	,,	June 26	4	Do. Deb. Stk.	104—106	..	3 15 6

Issue	Share	When ex-Dividend.	Div dend or D vidend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
195,242	Stk.	Aug. 27	6	Lea Bridge Ord. 5 p.c.	116—120	..	5 0 0
75,000	5	June 26	6	Malta & Medn., Ltd.	4¼—4¾	..	6 6 4
560,000	100	Oct. 1	5	Met. of 5 p.c. Deb.	100—102	..	4 18 0
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	99—101	..	4 9 1
541,920	20	May 29	3⅜	Monte Video, Ltd.	11½—12½	..	5 12 0
1,775,892	Stk.	July 30	4/12/6	Newc'tle & G'tesh'd Con.	108—109	+½	4 4 10
418,460	Stk.	June 26	3½	Do. 3½ p.c. Deb.	90—92	..	3 16 1
15,000	10	Aug. 27	10	North Middlesex 10 p.c.	19½—20½	..	4 17 6
55,940	10	,,	7	Do. 7 p.c.	13—14	..	5 0 0
300,000	Stk.	Apl. 29	8	Oriental, Ltd.	140—143	..	5 11 11
60,000	5	Sept. 30	8	Ottoman, Ltd.	6—6½*	..	6 3 1
31,800	53	Aug. 27	13	Portsea Island A	135—140	..	4 18 6
60,000	50	,,	13	Do. B	150—135	..	4 16 4
100,000	50	,,	12	Do. C	120—125	..	4 16 0
114,800	50	,,	10	Do. D and E	100—110	..	4 10 11
398,490	5	Apl. 29	7	Primitiva Ord.	5¾—6¼	..	5 12 0
796,980	5	July 30	5	Do. 5 p.c. Pref.	4⅝—5⅛	..	4 17 7
488,900	100	June 1	4	Do. 4 p.c. Deb.	97—99	..	4 0 10
1,000,000	10	Oct. 15	8	River Plate Ord.	13—13½*	..	5 18 6
312,650	Stk.	June 26	4	Do. 4 p.c. Deb.	92—94	..	4 5 1
250,000	10	Sept. 30	8	San Paulo, Ltd.	14—14½	+½	5 10 4
125,000	50	July 1	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Sept. 11	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	239—241	..	4 3 0
523,500	,,	,,	10	Do. C	238—240	..	4 3 4
70,000	10	May 29	10	South African	13½—14½	..	6 17 11
6,429,895	Stk.	Aug. 13	5/6/8	South Met., 4 p.c. Ord.	120—122	..	4 7 4
1,895,445	,,	July 15	3	Do. 3 p.c. Deb.	84—86	..	3 9 9
209 820	Stk	Aug. 31	8	South Shields Con. Stk.	152—154	..	5 3 10
605,000	Stk.	Aug. 13	5/6/8	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 10 4
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—122	..	4 2 0
117,058	,,	July 15	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 14	5	Southampton Ord.	108—113	..	4 8 6
120,000	Stk.	Aug. 13	6¾	Tottenham and Edmonton } A 5 p.c. B 3½ p.c. 4 p.c. Deb.	132—137	..	4 18 6
398,940	,,	,,	5¼		105—108	..	4 17 3
149,470	,,	June 26	4		102—105	..	3 16 2
182,380	10	June 12	8	Tuscan, Ltd.	10—10½	..	7 12 4
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	99—101	..	4 19 0
193,742	Stk.	Aug. 27	5	Tynemouth 5 p.c. max.	104—106	+⅛	4 14 4
255,636	Stk.	Aug. 27	6½	Wandsworth and Putney } B 3½ p.c. 3 p.c. Deb. Stk.	125—130	..	5 0 0
79,416	,,	June 26	3		73—78	..	3 16 11
845,872	,,	Aug. 27	5⅜	West Ham 5 p.c. Ord.	102—105	+1	4 17 7
185,000	,,	,,	5	Do. 5 p.c. Pref.	118—123	..	4 1 3
228,300	,,	June 26	4	Do. 4 p.c. Deb. Stk.	100—105	..	3 16 2

Prices marked * are "Ex div."

"Shop Lighting up to Date" is the title of a new list showing many kinds of gas-lights for shops, &c., which has been issued by Messrs. J. & W. B. Smith, of No. 17, Farringdon Road, E.C. The cover bears the simple truth that "A good light is as important as a good location;" and the inside contains illustrated particulars of the latest patterns of inside and outside lamps supplied by the firm for the purpose named. They also issue a list showing special lines in single pendants and hall pendants for inverted burners.

An order has just been placed with Messrs. Ashmore, Benson, Pease, and Co., Limited, of Stockton-on-Tees, by the Sunderland Gas Company, to add a fourth lift to the 100 feet holder at the Ayres Quay Gas-Works, on their improved patent steel cable system. This holder when finished will have two lifts flying above the guide-framing; the third lift having been added on the cable system in 1899. The old outer lift is also to be re-sheeted; and the inner lift will be entirely new. The work is to be carried out under the supervision of Mr. Charles Dru Drury, the Company's Engineer. Messrs. Ashmore, Benson, Pease, and Co., who have also completed the addition of a third lift to one of the large holders at the Barrow Corporation Gas-Works, have now been instructed by the Committee to add a third lift to another holder of the same size. These holders when completed will each have two lifts rising clear of the guide-framing, and guided on their improved patent steel cable system. The contract now in hand is the fourth of the same character entrusted to the firm by the Corporation; and the work is to be carried out under the supervision of Mr. W. Fergusson, the Engineer of the Gas and Water Works.

"ILLUMINATING TRUTHS."

LEAFLETS FOR DISTRIBUTION.

No. 1.—"The Sanitary Aspects of Gas and Electric Lighting."
No. 2.—"The Cleanliness of Illuminants: The Eyesight."
No. 3.—"Fire Risks."
No. 4.—"The Relative Cost of Gas and Electricity, and Matters affecting it.
No. 5.—"On Reliability, with Instances of Misplaced Confidence."
No. 6.—"On Shop Lighting, with Special Reference to the Flame Arc Lamp."
No. 7.—"The Osram Lamp: Fiction and Fact.

This series of Leaflets will be useful, not only for distribution among Householders generally, but for circulation among Shareholders to fortify them with arguments in defence of the commodity in which they have invested capital. Copies of each Leaflet should also be kept in every Gas Undertaking's Show-Rooms.

Prices for Quantities on Application to WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

MANAGER. Ayr Gas Company. Applications by Nov. 30.
FOREMAN. Ulverston Gas-Works.
STOKER. No. 5003.

Pupil Required. No. 5004.

Meeting.

CEARA GAS COMPANY. London Offices. Oct. 30. One o'clock.

Plant (Second-Hand) for Sale.

PURIFIERS, &c. Llynvi Valley Gas Company.
PURIFIERS, STATION METER, &c. Seaham Harbour Gas Company.
RETORT IRON WORK, &c. Swansea Gaslight Company.
WATER-GAS PLANT. No. 5002.

Stocks and Shares.

ASCOT GAS AND ELECTRICITY COMPANY. Oct. 26.
BRIGHTON AND HOVE GAS COMPANY. Oct. 26.
BRISTOL WATER COMPANY. Oct. 29.
ILFORD GAS COMPANY. Nov. 3.
LITTLEHAMPTON GAS COMPANY. Oct. 27.

Stocks and Shares—*continued.*

MITCHAM AND WIMBLEDON GAS COMPANY. Oct. 26.
PINNER GAS COMPANY. Oct. 26.
PORTSMOUTH WATER COMPANY. Nov. 2.
SEVENOAKS WATER COMPANY. Oct. 31.
SOUTHEND WATER COMPANY. Nov. 3.
WEST KENT GAS COMPANY. Oct. 26.

TENDERS FOR

Fire-Clay Goods.

SHEFFIELD GASLIGHT COMPANY. Tenders by Nov. 2

Tar.

NEATH GAS DEPARTMENT. Tenders by Oct. 31.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

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See Advertisement on p. 226.
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